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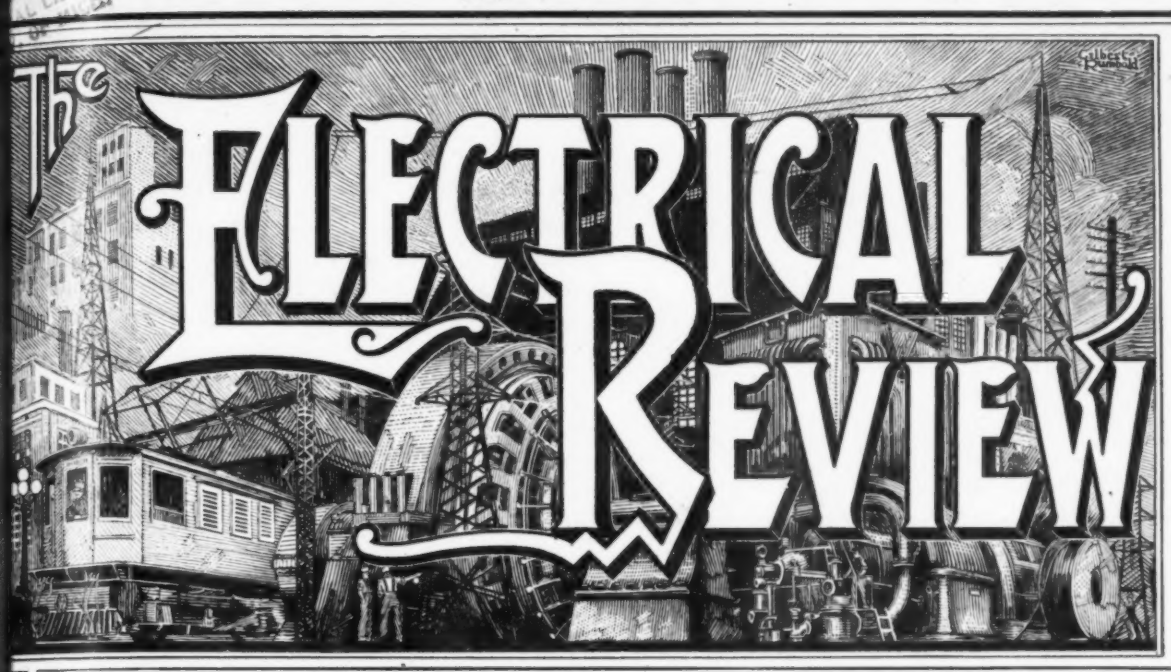

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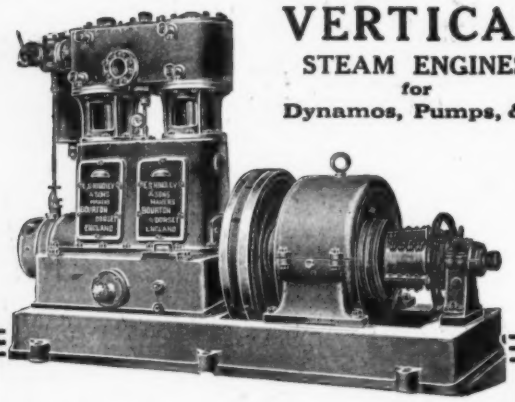

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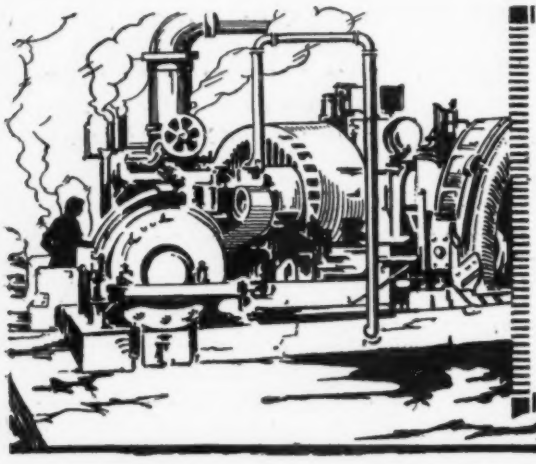

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THE
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VOL. XCIII. AUGUST 3, 1923. No. 2,384.

ELECTRICAL REVIEW.

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MESSAGE TRANSMISSION AND COMPETITION.

FROM the remarks of Sir John Denison Pender at the general meeting of the Eastern Telegraph Company last week, it is to be inferred that the submarine-cable industry has lost nothing of its zest and zeal in the presence of competition, and that it continues to find a stimulus in that friendly rivalry with other modes of communication which has characterised it since it first entered into conflict with space and time in the middle of last century. Both on this occasion, and at the corresponding meeting of the Eastern Extension Telegraph Company, the chairman's observations formed an illuminating commentary upon the present aspect of general, home and Imperial affairs. Indeed, in view of the intelligence system that naturally extends along the far-flung lines of communication over which the "Eastern" group operates, it would be difficult to find a surer indication of the trend of British and foreign trade, or of the world's appeal for increased facilities for telegraphy and telephony, than his words provide.

There is special significance in the circumstance that this appeal by the world at large for an extension of the means of linking-up producer and user, buyer and seller, and the countless interests that constitute trade and fellowship, synchronises with a decline in average business. The falling off is even manifested in the report and accounts which Sir John Pender placed before the shareholders of his companies. In contrast with the general depression, however, he was able to cite facts that indicate a thriving future for the submarine-cable industry. Manufacturers of such cables will have plenty of work on their hands, but competition will be keen; thus although they must be prepared for reduction in the scale of profits, they may confidently expect increased turnover to restore the balance.

When examined on broad lines, the relationship between cause and effect in this matter may be interpreted in various ways, for the appeal for increased means of communication at a time of general depression is somewhat beyond the range of the simple law of supply and demand. It is a demand for a demand, an endeavour to re-establish a condition of supply and demand that once ruled and now is absent—a theme for theologians, strategists, and politicians. But when all is argued and said, it implies that traders want cheaper means of intercommunication, and that they intend to have it, through the agency of either telegraphy, telephony, or "wireless."

Sir John Pender repudiated the suggestion that he had ever stated that "wireless" was pushing the cable companies hard. He limited himself to indicating that "wireless" was pushing hard, in general terms. He said he had never predicted what "wireless" was going to do; and he proceeded to enumerate the cables in contemplation, or in course of manufacture, for Italy, South America, Australia, Fiji, Germany, and elsewhere.

The point at issue is by no means new. For example, it was discussed early in 1914 by the Royal Commission over which Sir Rider Haggard presided, when considering the natural resources, trade, and legislation of certain portions of His Majesty's dominions; but its importance has developed considerably since that time. Under healthy conditions, competition between such enterprises as telegraphy, telephony, and "wireless" injures none of them; it enhances the activities of all, in proportion to their respective efficiencies and applica-

bilities to the particular classes of transmission they are called upon to perform. If by famine or pestilence there were a sudden and serious diminution within the community of the intelligent, the inquisitive, the importunate, the avaricious, the anxious, the lonely, the amorous, and the desperate, who insist upon getting into communication quickly with their agents, friends, and victims, there might for a period be embarrassment among those who provide one class of transmission more than among those who provide another. The field of operation, however, is so wide, and the population in general so rapidly increasing at the centres concerned, that the idea of telegraphy, telephony, or "wireless" by competition driving one another out of the market, cannot be entertained. Ultimately they assist one another, as the baker the butcher, and the butcher the greengrocer, in the same street. In a word, so vast is the demand that it is almost beside the issue to imagine that competition of a character destructive to the volume of business in transmission of messages is to be contemplated.

Competition of the kind that reduces prices, however, is to be expected and welcomed. To bring about this result, the Governments of the world must act together to prevent monopolies. If telegraphy, telephony, and "wireless" are ever seen under the same umbrella, the trading community may expect violent rain. The words of Sir John Pender, following his remarks on "pushing hard," therefore deserve special attention. He is reported as having said to his shareholders: ". . . your board hold the opinion that they should be associated with all classes of telegraphic communication, and with this object they are associated with applications for wireless licences for full-powered stations in Great Britain, India, and China."

High-pressure Research.

The needs of the time are directing research work more and more towards high-pressure phenomena, both mechanical and electrical. We recently drew attention to the impending tests on a steam boiler using a pressure of 3,200 lb. per square inch, at Rugby; the manufacture of underground cables for pressures upwards of 60,000 volts between phases has passed the experimental stage in this country, and the behaviour of electricity at pressures up to two million volts is being closely studied in the United States, as indicated elsewhere in this issue, where overhead transmission lines are now in operation at 220,000 volts. Naturally, when one is approaching the pressures at which lightning discharges take place, the phenomena observed more and more closely resemble those of Nature's own electrical displays, and the performance of lightning arresters under artificial lightning flashes can be studied in the laboratory. Formerly the only way of appraising the merits of different types of arresters was to put them into use; if they protected the lines and apparatus concerned, they were presumably effective—if the apparatus was destroyed by lightning, obviously the arrester responsible for the damage was not satisfactory. Such tests not only required months for completion, but also might prove very costly. In some cases elaborate provision was made for recording the number of times that lightning arresters were called upon to function—information that was of great value in other respects besides that which concerned the efficacy of the arrester itself.

But nowadays, thanks to the improved means of generating impulsive discharges at enormous pressures, the testing of lightning arresters can be carried out expeditiously and safely. At the recent Convention of the American Institute of Electrical Engineers apparatus developed by the Westinghouse Electric and Manufacturing Co. for this purpose was for the first time publicly exhibited in operation. Discharges at 200,000 volts impressed the spectators, and 15,000-volt pin-type insulators were flashed over repeatedly; it was shown that a sphere gap with a series resistance of 1,000 ohms failed to protect the insulator, but an "autovalve" arrester was effectual. The discharges were obtained by charging a condenser of 0.1 microfarad to 200,000 volts and discharging it through a circuit having an inductance of 20 microhenries and a surge impedance of 14.1 ohms, the maximum current therefore being 14,000 amperes, and the maximum instantaneous power no less than 2,800,000 kilovolt-amperes. A vast amount of work remains to be done in this field, but the means and methods available are now adequate for the purpose.

Examination of Patent Applications.

In last week's *Bulletin* of the Federation of British Industries reference is made to an intimation received from the Chartered Institute of Patent Agents to the effect that the Patent Office, in addition to searching to see if an invention has been anticipated, has begun to refuse applications for patents on the ground that they are lacking in invention. The Grand Council resolved that this practice was extremely undesirable and that the jurisdiction of the Patent Office should be restricted to the question of anticipation, and steps will be taken, in co-operation with other bodies, to bring the matter to the notice of the Government.

In some respects the practice of the American and German Patent Offices has advantages over that of ours, but in so far as the former constitute themselves technical experts and pass judgment on subject-matter we believe they work on wrong lines. Notorious cases are on record in which the American Patent Office has sought to reject, on the ground of lack of invention, or of impracticability, applications for inventions which have eventually proved to be of the utmost importance and value to civilisation, and has delayed for years the issue of patents on flimsy pretexts. We cordially agree that any attempt on the part of the British Patent Office to emulate such practices should be summarily condemned and frustrated, and we trust that the action contemplated by the Federation will receive the support of all electrical associations.

London Traffic.

The announcement recently made that the Ministry of Transport had prepared a scheme for dealing with the problem of traffic in London streets seemed almost too good to be true; after so many years of agitation without result, we had practically given up hope of seeing any real effort towards reform in our time. However, the necessity for vigorous action had become so pressing, in view of the constantly-increasing congestion in the main thoroughfares, that presumably the most zealous advocates of dilly-dallying could no longer hold out against the pressure of circumstances—something *had* to be done. Whether the proposals put forward by the Ministry will prove acceptable to Parliament remains to be seen; there are obvious objections to them, and the innumerable authorities concerned, each anxious to grind its own little axe, will invent plenty more—but we will not raise a finger to hamper the efforts of a department which has at least made a preliminary move towards finding a remedy for the creeping paralysis with which this overgrown metropolis is afflicted. Rather will we do all in our power to ensure that the whole matter shall be brought under the control of a single authority, above the influence of local jealousies and parochial bumbledom, and capable of dealing with it with sole regard to the well-being of the community.

Imperial Intelligence.

The slogan "trade within the Empire" is growing more insistent as the complete recovery of Central Europe seems to become more remote and the date of the Imperial Economic Conference grows nearer. All competent observers see the pressing need for new outlets for British manufactures to take the place of pre-war markets which are still unable to resume their

normal purchases of either ready-made goods or raw material for their own factories. India, Canada, Australia and South Africa—all feel the lack of many of their old customers for their produce whilst they, like many less developed fields such as West and East Africa and the West Indies, possess also rich unexploited resources. To bring this wealth forward on to the world's markets would mean additional employment not only in the countries of production but also in transporting the produce, marketing it and transforming it into the finished article. At the same time these new and increased supplies of foodstuffs and other raw material should cheapen production, reduce the cost of living, and improve the purchasing power of the community. Great Britain is about the only country from which the Empire may now expect such assistance as is required in finding markets for raw materials. The United States, although in a high degree desirous of widening the field of sale for the output of her factories, is in a less degree willing or in any need to buy raw material. In return, Great Britain will naturally expect to find in the Empire a larger number of buyers of her manufactured or half-finished goods. This important question of the advancement of trade within the Empire should therefore be one of the first to receive the earnest attention of the Imperial Conference. Closely linked with it is the problem of ensuring the best possible means of making known to the United Kingdom merchant and manufacturer the Empire's present and potential resources of raw material on the one hand and the Empire's needs in technical advice, engineering equipment, factory plant and manufactured articles generally on the other. On all sides there is room for co-ordination and improvement. Whether the Dominion representatives in London work in close enough connection with each other and with such bodies as the Imperial Institute and the British Empire Producers' Organisation is a matter that concerns the overseas authorities. What vitally affects us, however, is that no opportunity of reciprocal and mutually beneficial trade should be lost. Yet in all the discussions regarding the programme of the Conference we have seen little mention of any proposal for bringing the British manufacturer into more intimate touch with the Dominion buyer. The Department of Overseas Trade might do more in this direction, but it is given little chance of expansion, although business men recognised the false economy which characterised the Geddes Committee's recommendation of its virtual extinction. We have always urged that the D.O.T. was capable of good work, and that the Government should regard it as something more than a mere training ground for junior parliamentary administrators. The numerous reports it issues from the pens of its Trade Commissioners, Consuls, &c., are of considerable utility, though at times rather belated and expensive. *The Times* Trade and Engineering Supplement pleads for an extension of the Department's system of supplying British firms with the names of oversea buyers, and mentions a system devised by Admiral Campbell, presumably that of the "K" form, which we understand is considered capable of wider and more speedy application by means of the cable and a special cable code. We hope that this subject of a rapid and efficient intelligence service between London and the Dominions will be carefully investigated at the Conference in order that the D.O.T. and its officials may be equipped in the best possible manner for rendering service to the cause of Empire trade.

The Fair and the Exhibition.

In consonance with the generally-expressed desire of all concerned, a very logical desire, the Department of Overseas Trade, the Birmingham municipality, and the Birmingham Chamber of Commerce have arranged for next year's British Industries Fair to be held at a later date. This wise decision will enable a very large number of visitors to this country, from our Oversea Dominions and from foreign countries, to attend both the Fair and the Empire Exhibition which commences at about the same time, permitting them to gain a comprehensive idea of what the British Empire can produce and how well she can produce it.

The Department of Overseas Trade points out that the two exhibitions are in no way competitive, but rather complementary. In any event they are of distinctly different character. The Fair is confined to the participation of manufacturers, and only *bonâ-fide* trade buyers are admitted. ("Officially," we may add!). The Exhibition, on the other hand, is open, as regards participation, to all branches—manufacturing, factoring, and retailing, and admission will be unrestricted; in fact, the presence of the general public will be one of the main factors in the success of the Exhibition, for, after all, it is the public which is the ultimate buyer, and the education of the final consumer plays an important part in the promotion of trade.

Another important change in the arrangements of the British Industries Fair is the holding of the two sections —London and Birmingham—consecutively instead of concurrently as heretofore. The London section will be open at the White City from April 28th to May 9th, while the Birmingham section will run from May 12th to 23rd. One of the reasons put forward to account for the poor attendance at last year's Fair was that the two sections divided the visitors between them, many not being able to "do" both sections in the few days available. Of course there may be another angle from which to view this circumstance, but we hope that the alteration will bring more buyers to next year's Fair than was the case in the present year.

It is not too early for exhibitors to notify the Department of their intentions; a preliminary statement has been issued by the D.O.T. in which a schedule of trades for the London section is given. To our mind this rearrangement of dates to bring the two functions into one period affords an excellent opportunity for the organisers to co-operate upon the publicity side, and to make the events known in all parts of the world. We trust that full advantage will be taken of it.

Pan-American Standardisation.

With the object of encouraging the tendency towards the greatest amount of interchangeability, especially with respect to small component parts, the subjects of simplification in manufacture and the unification of methods and works are being given prominence in both technical and lay circles in the U.S.A. Because of their influence on national economy, that is to say, in the elimination of waste, they are frequently discussed in the daily as well as in the technical Press.

In this connection it is of interest to note that strenuous efforts are being made by America to persuade the South American Republics to give preference to her manufactures. Evidence of such activities is to be found in the fact that it is proposed to hold next year a Pan-American Conference on Standardisation at Washington. It is to be under the aegis of the United Department of Commerce, of which Mr. Hoover is the very able secretary; the South American Governments are to be invited to participate in the Conference, and it is presumed that the governing idea will be an endeavour to obtain the adherence of the various American Governments to American standards.

It should be borne in mind, however, that American manufacturers, except those of special lines, cannot be described as large exporters of industrial products; they concentrate more on satisfying their domestic demands, while the fact that European industries are heavily dependent on their export trade cannot be denied.

It is for this reason that the Conference referred to should be made widely known to British manufacturers. The British Engineering Standards Association is rightly calling attention to the movement, which merits the closest attention of manufacturers in this country, inasmuch as it has an important bearing on export trade, the maintenance and development of which is of such significance at the moment.

POWER FACTOR.

By F. E. J. OCKENDEN.

To the modern power-station engineer the following story, told by Mr. J. Swinburne at the Commemoration Meetings of the I.E.E., might appear almost incredible. Narrating some reminiscences of the early days, he said:—"One cause of the different mental equipment of the electrical engineer of to-day, and of 40 years ago, is the advance of real education. Matters that were difficult to understand in the early 'eighties are now quite elementary. Thus, about 1884 Hopkinson called attention to the fact that the product of volts and amps. in an alternating-current circuit is not necessarily the watts. They had an alternator at Brighton; they tried it on an inductive circuit, and found the indicator diagram smaller than the apparent watts warranted. Somebody told one of our esteemed past-presidents of this. He regarded his informant severely, but thoughtfully for a few moments, and replied: 'You're a liar!'"

Such a story brings home with extraordinary vividness the obscurity in which early ideas of power factor were cloaked. To-day not only is its importance universally recognised, both with reference to power-station efficiency, on the one hand, and the consumer's liability on the other, but the instruments required for ascertaining its exact value have enormously improved in both accuracy and simplicity. A brief note of the history of power-factor measurement and the instruments available for this purpose may perhaps be of more than a little interest.

The power factor of any circuit is, of course, the ratio between the "apparent watts" or volt-amperes and the true watts; this quantity, *i.e.*, W/VA, is the cosine of the phase displacement between current and pressure.

To estimate the p.f. by this method is, however, tedious, nor does it tell in itself whether the angle is a lag or a lead; it was consequently soon superseded by the crossed-coil meters of Tuma and Punga, in which two or three coils mounted on a staff (to which was attached a pointer, the whole being free to swing over a scale) were so connected as to produce a rotating field in phase with the line pressures.

This rotatable unit was surrounded by one or more pairs of coils connected, usually by transformers, in series with the line currents, and thus also producing a rotating field.

The rotor, being free to move, tended to set itself in such a position that the two rotating fields were in time-phase agreement, the displacement of the moving system required to produce this result being a precise measure of the phase angle of the circuit in degrees; more usually, however, the scale was marked off proportionally to the cosine of this angle, the instrument thus becoming a direct-reading power-factor meter.

Since flexible connections had to be made to the moving coils, the travel of the rotor was practically limited to some 300 deg. of arc, and should a reversal of power factor occur while the pointer was in the lower half of the scale, the former usually jammed against the stops, remaining there until the power flow once again became normal, the instrument being meanwhile completely out of action.

To avoid this "impasse," the so-called induction type of p.f. indicator was introduced with its well-known central fixed pressure coil and two rotatable sector-shaped irons mounted Z-fashion on a central magnetic spindle (fig. 1).

This great advance, however, had two or three outstanding imperfections. The effect of the rotating "current" field on the centre irons was to exert a permanent drag on them, causing appreciable errors with varying loads.

These irons, moreover, had to be mounted with extreme accuracy in the centre of the pressure coil, failure to achieve this causing them to have a heavy bias towards that part of the coil to which they were nearest. The centre coil, too, was necessarily highly inductive, consequently its phase angle, and therefore the instrument reading, varied badly with any change in frequency; owing also to the amount of stray field radiated by the coil in all directions, it was impossible to use two or more such coils and their appropriate irons with a view to producing an instrument suitable for unbalanced loads.

Some attempt has been made of late years to overcome this fundamental difficulty by increasing the vertical separation of the coils, but the result is to produce a high and somewhat unsightly instrument.

These, then, were some of the difficulties awaiting solution when the author first took in hand the problem of producing a satisfactory power-factor meter giving a "rotary" or 360 deg. scale and suitable for unbalanced loads of varying frequency and voltage.

Of them, the most vital was the reduction of the interference between pressure coils due to their stray fields. The original and most obvious arrangement tried is shown in fig. 2, where A_C and B_C represent two coils connected in open delta to phases *a* and *b* respectively of a three-phase circuit. Three irons, A, B, and C, are

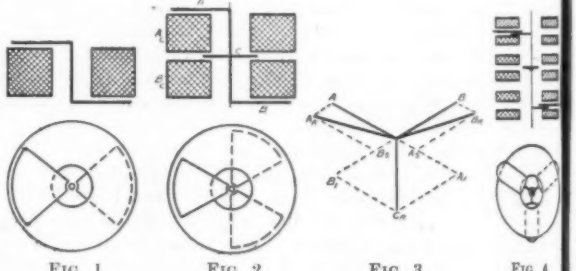

FIG. 1. FIG. 2. FIG. 3. FIG. 4.

mounted in the positions shown. The iron C should then be magnetised in phase with *c* (*i.e.*, the resultant field of A and B reversed), the iron A in phase with *a*, and B in phase with *b*.

Owing, however, to the stray field from coil B_C reaching A, and *vice versa*, the actual phase angles of the irons are as shown in fig. 3, where

A and B represent the fields due to A_C, B_C, excited singly.

A and B represent the reversed fields in the gap, magnetising the centre iron in phase with their resultant C_R when both are excited.

A_s and B_s, the portions of the stray field, reaching B and A respectively.

A_R and B_R, the resultant fields magnetising A and B.

The phase relations, A_R, B_R, C_R, of the irons as thus arranged are, in fact, very different from 120 deg., the phase displacements of the pressure circuit to which the coils are connected.

To obviate this interference, a novel scheme has been devised, and is shown in fig. 4, whereby each of the three irons mechanically spaced at 120 deg. is excited by means of a pair of thin coils mounted with their similar poles *face to face* (*i.e.*, astatically), the irons being free to revolve in a narrow gap between the coils. Each pair of coils is connected in series, the three pairs being connected in star to phases *a*, *b*, and *c*.

The advantages of this scheme are many. Since the whole of the field produced by the coils must be concentrated in the gap, the arrangement is equivalent to enclosing the iron in a very narrow coil having a large number of turns, thus giving a corresponding increase in efficiency and torque. Also, if there were no iron

present, the coils, as a pair, would be practically non-inductive. Consequently, the only flux produced is that which magnetises the iron itself, and the stray field is reduced to a negligible quantity. In fact, by this method it is possible to mount three irons each complete with its pair of magnetising coils in the small vertical space of 2½ in. without any one iron being affected by the presence of the other two.

Moreover, the non-inductive properties of the coils, as a pair, and hence their exceedingly small phase angle, render this form of excitation practically independent of frequency, variations of 50 per cent. in the latter causing errors of less than 2 deg. in any part of the scale.

In spite of statements frequently made to the contrary, it has been found that careful design and attention to detail will reduce the error due to rotational "drag" practically to zero. The exact shape of the iron used is the deciding factor, and a special shape has been developed which, while giving as high a torque/wt. ratio as the conventional sector shape, is almost entirely free from the errors usually associated with this design, thus removing this last objection to the employment of the induction principle in power-factor indicators.

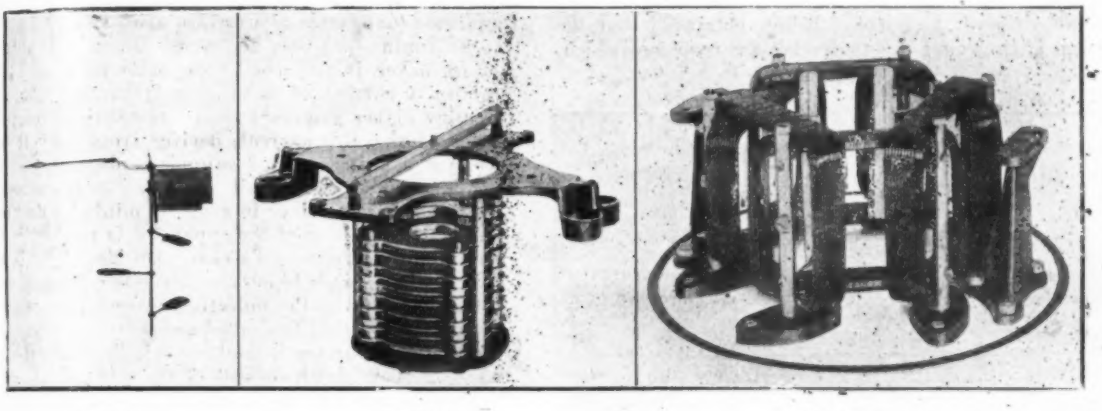

Fig. 5a. Fig. 5b. Fig. 5c.

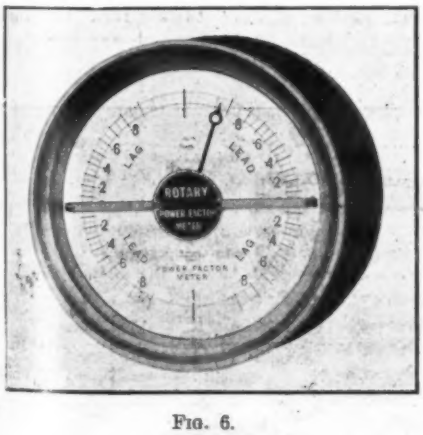

Fig. 6.

An instrument of this type is now available which may be used on a three-phase 3- or 4-wire circuit, and which will accurately indicate the average* power factor of the circuit however unbalanced the load may be, or will indicate the p.f. of any one phase should only one be loaded, or the current transformers of the other two be short-circuited for the purpose. Moreover, such an instrument, calibrated at, say, 50 cycles, may be used on any frequency between 25 and 100 cycles without noticeable loss of accuracy.

Some idea of the general construction may be gained from fig. 5, which shows an "exploded" view of the movement, as follows:—

At the left.—The staff, of light yet strong construction, having mounted on it three irons, spaced at angles of 120 deg. the pointer, and damping vanes.

In the middle.—The pressure-coil system, a set of six coils arranged in pairs, face to face, with a narrow gap between in which the irons are free to swing.

At the right.—The current-coil system, consisting of six coils arranged as an interlacing hexagon round the centre or pressure unit.

The field produced in this way is exceedingly even, and truly radial, resulting in an even scale and freedom from jerkiness when the pointer moves through wide angles.

This construction possesses a unique feature in that the pressure unit is easily insulated from the current side, and may, moreover, be completely withdrawn from it for repair or adjustment without in any way dismantling the moving parts. This feature greatly facilitates accurate construction, calibration, and any subsequent handling.

The last illustration, fig. 6, is a view of the completed instrument, showing it to be normal in height and general dimensions, matching in appearance and finish the instruments usually supplied for switchboard use.

The writer wishes to express his thanks to Messrs. Everett, Edgcumbe & Co. for their kindness in permitting him to publish the results of work undertaken on their behalf, and for their assistance in the preparation of photographs, diagrams, &c.

* Vector average.

An American Dry-Cell Specification.—The United States Federal Specifications Board has adopted, for the use of Government departments, Standard Specification No. 58, which sets out the sizes required, details of construction, and particulars of the tests to which dry cells are to be subjected. The specification (which is issued by the Department of Commerce) classifies the batteries under several heads, *e.g.*, telephone, flash light, radio, &c., and specifies sizes for these various types. Regulations as to the zinc container, sealing compound, terminals, and connections are given. The section devoted to tests puts these in two categories—intermittent and continuous—and the cells are subjected to the test which best shows their suitability for the particular class of work for which they are intended. A final section sets out in tabular form the performance which is required from each class of cell.

Electricity for the Electrical.—At a time when the importance of the use of electrical appliances by those engaged in the industry is being stressed, it is of interest to learn of the result of a recent *questionnaire* circulated among employés of the principal "Hydro" municipalities in Ontario. According to the *Electrical News* (Toronto), 490 cards were returned and these showed that the following numbers of appliances were in use: Irons, 487; toasters, 349; percolators, 128; grills, 133; vacuum cleaners, 203; water heaters, 25; dish washer, 1; air heaters, 159; clothes washers, 149; ranges, 105; refrigerators, 3; miscellaneous, 20.

AN ELECTRIC CHRONOSCOPE.

By G. E. MOORE, A.M.I.E.E.

Some time ago the writer began experiments with a view to evolving an apparatus which would give upon a dial or series of dials a direct and accurate measurement of time intervals. It is, of course, a comparatively simple matter, under laboratory conditions, to measure periods of time to a high degree of precision, a photographic record, as a rule, being obtained; but the object of the writer was to develop a chronoscope which,

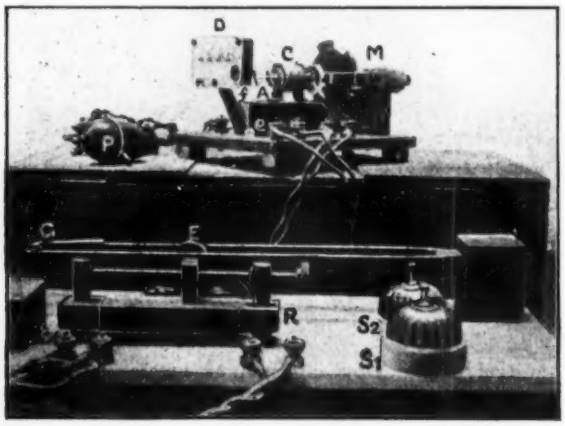

Fig. 1.—An Experimental Chronoscope.

displacing the ordinary stopwatch (with all the latter's imperfections under workaday conditions), would provide a means of measuring time to within .01 sec. in a run of 50-100 seconds, preferably operable from a distance, and robust enough for use in a meter and instrument test-room.

At the same time, and quite unknown to the writer, Dr. Wood and Mr. Ford, of the Admiralty Experimental Station, Shandon, were working along somewhat similar lines, as so often happens, and won the race in the Patent Office, obtaining their patent soon after the writer had deposited his provisional specification. Fundamentally, the invention of each party is the same. The writer is presenting herewith a brief description of his experimental apparatus, partly because the principle is important and partly because the methods and incidental improvisation in both construction and testing may be of interest.

The principle of the device is as follows:—

A tuning-fork (like the pendulum) involves a definite time element and may readily be calibrated as a convenient standard; if, in addition, it be kept in continuous vibration (as a rule, electrically), it provides a reference available for comparatively long periods of time. Such a tuning-fork can, by its interruption of an incidental circuit, drive a so-called "phonic motor," which may be said to rotate in synchronism with it, and hence revolves at a standard rate. This combination is not a new thing: in one form or another it has often been utilised and has figured before in these pages. It forms one of the two parts of the chronoscope—the *standard driving element*.

The second part, which may be termed the *indicating arrangement*, consists of a dial or series of dials which are "clutched" to the driving element at the commencement of a time period and de-clutched at the end of the latter. It will readily be understood that the calibration of the dial or dials in terms of time is a simple matter.

The experimental chronoscope is shown in the accompanying illustration, fig. 1. In the foreground is seen the tuning-fork (of 50 double vibrations), and between its limbs the exciter coil E. In series with the latter is a spring contact-maker actuated by one of the limbs, a rheostat R, switch S_1 and a 2-volt cell. Once the fork has been started, the unidirectional current, pulsating at the fork's frequency, maintains it in constant vibration, and with one setting of the contact-maker the amplitude (and hence to a certain extent the frequency) of the tuning-fork may be varied by R. A similar contact-maker is actuated by the other limb, and this provides a current of unvarying frequency, but considerably higher amperage than that required to maintain the fork; this current, derived from a 6-volt battery, *via* a switch S_2 and suitable leads, actuates the phonic motor M. A small condenser K is connected across the contact-maker in order to minimise flashing.

The second portion of the apparatus is resting on the cover of the chronoscope's case. On the right is the motor M, of a simple bipolar construction, the two coils of which are fed by the pulsating current just referred to, and a five-toothed laminated armature. In line with the shaft of the motor is the loose spindle of the electric clutch C. This clutch consists of the said spindle passing through a coil (of very small time-constant); a light iron disk (on left of coil) mounted on the spindle and pulled towards the coil when the latter is energised (a more effective design than that of a pure plunger); and at X a *fixed* disk, a disk attached to the spindle end, and a third mounted on the projecting shaft of the motor—all surfaces being covered with ordinary sandpaper. The indicating arrangement D is an old Chamberlain and Hookham meter dial, and the spindle of the .1's dial connects directly to the loose spindle of the electric clutch by means of the pin-and-spring device A, which allows play only in an axial direction towards the motor; the remaining dials are 1's, 10's, 100's, and 1,000's. When the chronoscope is not registering, the two parallel springs at A pull the spindle disk at X against the left-hand stop-disk.

Closing switch S_1, the tuning-fork is started by "springing" it or by a blow on the board. Motor

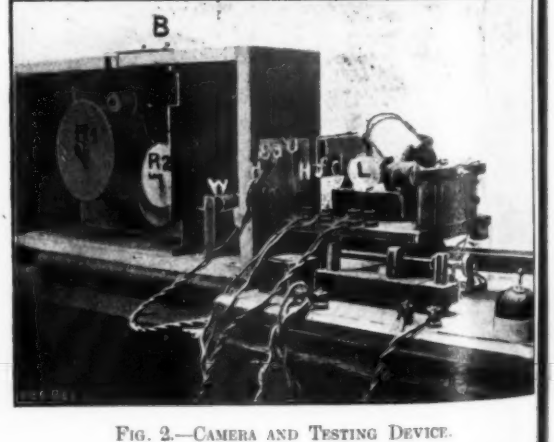

Fig. 2.—Camera and Testing Device.

switch S_2 is then depressed and the armature spun until it is felt and heard to pull into step and rotate at 50/5 or 10 revs. per second (5 revs. per second may be obtained with rather more difficulty—but this rate, as a rule, is not required). If now the current be switched on to the electric clutch, the loose spindle is forced against the tension of the springs at A towards the motor, its contact disk gripping that on the projecting shaft of the latter; thus, the motor, the transmitting spindle of the clutch, and the dial system are all in motion

As has been pointed out, the .1's dial of the indicating arrangement is connected to the clutch spindle, and it therefore, like the motor, makes 10 complete revolutions per second; hence, one-tenth of one of its 10 divisions represents .001 sec. There being no zero re-setting device in the experimental chronoscope, it is necessary to take a dial reading before operating the clutch and to note the advance after switching off.

The electric clutch, it should be mentioned, is controlled by any form of near or distant switch or the like. A pear-switch (P in fig. 1) has been used for timing meter revolutions, &c.

The accuracy of the tuning-fork being determinable and consistent, it was decided that the chronoscope dial advances should be compared with the tuning-fork; and in the event of such measurements being in phase (so to speak) with the latter, the accuracy of the whole apparatus with reference to true time values would be decided by the tuning-fork and corrective adjustment made thereto.

The first test (one that was repeated until satisfactory clutching was secured) consisted of a *stroboscopic* search for *running slip*. The tuning-fork was fitted at G with the well-known shutter device, by means of which a couple of aluminium vanes interrupt one's vision with a "glimpse frequency" equal to that of the fork. A tiny disk with a five-pointed star (to be seen in fig. 1 at *e*) was attached to the .1's dial spindle. With *nil* slip (and considering the tuning-fork as correct), the stroboscopic disk rotated 10 times per second, each star point travelled the point-to-point space in 1/50 sec., and, viewed through the shutter device, the star appeared stationary; when a slight hunting effect was audible in the motor upon clutching-in, the star appeared to oscillate slightly; while with running slip present, an apparent backward rotation ensued, which became erratic if the slip varied.

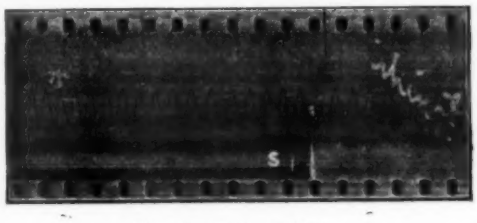

Fig. 3.—Testing Film.

This stroboscopic test was useful, but it did not give any clue as to starting and stopping conditions or as to dial indications compared with the tuning-fork. Photographic records which embodied the precise moment of switching the clutch on and off, the starting and stopping of the .1's dial finger, each revolution of this finger, and the actual fork vibrations were accordingly made by means of a specially-constructed camera. This, together with the complete testing arrangement, is shown in fig. 2.

On the left is the camera B, with its side removed. A horizontal slit is provided at H. A sprocket-wheel W, rotated from the outside (the far side), pulls kinematographic film from the feeding spool R_1 over bobbins and immediately behind the said slit, the film being rewound by R_2, which is driven externally by a slipping belt from a pulley on the sprocket-wheel shaft. At S_3 a sliding switch is so arranged that circuit-closing is effected by the two tin plates forming the slit being connected together *across the slit*. In front of the slit an upright (U) of thin aluminium tubing attached to one limb of the fork is free to vibrate; while the specially-lengthened finger of the .1's dial (*f* in figs. 1 and 2) can pass across the slit. A 50-c.p. lamp L throws the switch contacts, the tuning-fork pointer, and the lengthened dial finger in sharp shadow form on the film.

At the commencement of a test the chronoscope was operating on "no load," so to speak; the electric clutch circuit under control by S_4; the .1's dial finger over the slit; and the film in motion, the tuning-fork vibrations being recorded. The dial reading having been taken, switch S_3 was closed, the registering system accordingly working. At the close of the run S_3 was opened, the film stopped, and the dial advance noted. Upon developing the film the following data became available: All the fork vibrations (the reference basis); moment of switching-on; start of .1's dial finger (giving the time lag of clutch); each successive revolution of the said dial finger (furnishing a clue as to running slip); moment of switching-off; and the last revolution of the dial finger (the time lag here including a small dial advance *after* this). (Fig. 3 shows the ending of a test film; at the top is seen the passing of the dial finger, in the centre the t.f. vibrations, and at the bottom the switch S_3—the flash on opening the circuit being photographed.) The film data were considered in conjunction with the dial advance.

The following facts were obtained from such a test, the tuning-fork being regarded as correct:—

Dial reading at start 746.17.
Dial reading at end 760.48.
Therefore dial advance (secs.) 14.31.
T.f. vibrations, switching-on to switching-off 714.75.
Therefore true time = 714.75/50 = 14.295 secs.
Hence chronoscope error = +1 in 1,430, or +.07 per cent.
Lag on clutching = ½ t.f. vibration = .01 sec.
Lag on de-clutching = ½ vibration + .01 on dial = .02 sec.
No running slip whatever.

An "Intensity" Rain-gauge.—In connection with the important subjects of rainfall and run-off, which are intimately associated with the development of water-power, the intensity of the fall (*i.e.*, the rate of precipitation from moment to moment) has not hitherto been accurately measurable. Mr. J. W. Meares, C.I.E., late Electrical Adviser to the Indian Government, in the course of his extended investigations into the hydraulic resources of India, felt the need of an instrument which would perform this function, and devised an experimental apparatus which has given satisfactory results. This was exhibited at the recent conversazione of the Institution of Civil Engineers, and is described in a communication to the *Proceedings* of the Institution (No. 4,445) by the inventor. The principle utilised is that of "leaping weirs," the varying trajectories of jets of water at different velocities, according to the rate of discharge, causing the water to strike one or another of a set of such weirs. The device is extremely simple, and has no moving parts. In order to afford more detailed information of the progress of the rainfall a recorder has been devised which gives a permanent record of the order and intensity of the falls. Full particulars are given in the paper, which also contains many valuable data, and it is stated that the Meteorological Department of the Government of India is having further tests made, with a view to the commercial manufacture of the apparatus.

Northern Mining Electrical Engineers.—Members of the North of England Branch of the Association of Mining Electrical Engineers visited the electrical engineering works of Messrs. J. H. Holmes & Co., at Newcastle-on-Tyne, on July 21st. The whole of the extensive works were visited in groups. The concern was established in 1883, and among the interesting things shown to the visitors was the firm's [illegible] dynamo, built in 1895, which was, until a year or two ago, working continuously at a saw-mill in Ireland. The firm's products include a.c. and d.c. motors and dynamos, transformers, switchgear for high- and low-pressure circuits, starters for all types of motors, &c. Among other things shown to the visitors was a large testing set which the firm recently completed for the National Physical Laboratory. This motor-generator set is arranged to convert d.c. into a.c. at any frequency between 20 and 70 cycles per second, and either single, two, or three-phase for meter and general testing purposes. It consists of two 100-volt, variable-speed, direct-current motors, coupled to two alternators, the stator frame of one alternator being provided with an arrangement by which it can be racked round by hand or, alternatively, by a small d.c. motor. Another feature was the Holmes-Clatworthy automatic newspaper printing press control, which is operated entirely by push-buttons.

2,000,000-VOLT LABORATORY TESTS.

Artificial Lighting.

A man-made flash of lightning, releasing for an instant a force claimed to be greater than the total electric power used by the entire United States, was directed upon a miniature village built in the laboratory of the General Electric Co., at Pittsfield, Massachusetts, U.S.A., during tests just made public. This flash represented 2,000,000 volts, far exceeding the voltage ever before produced in any experiment with artificial lightning; in it was concentrated for a fraction of a second the enormous force of 10,000,000 horse-power, and it was directed at will by the hand of a man upon a switch.

This spectacular experiment is significant apart from its direct objective—an effort to improve and extend the present system of high-pressure transmission lines and to nullify and prevent the destructive effects of natural lightning. It has been discovered that when the artificial lightning strikes a

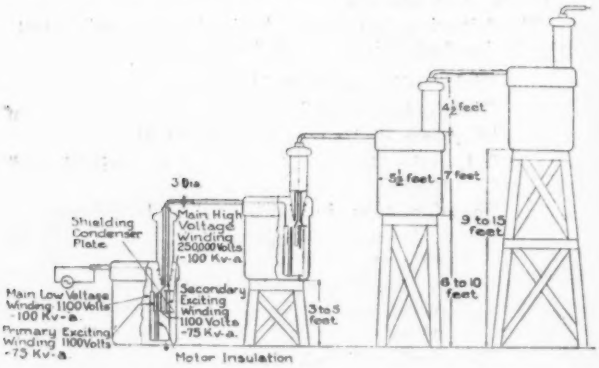
4½ feet
5½ feet
7 feet
9 to 15 feet
6 to 10 feet
3 to 5 feet
Shielding Condenser Plate
Main High Voltage Winding 250000 Volts -100 Kv-a
Secondary Exciting Winding 1100 Volts -75 Kv-a
Main Low Voltage Winding 1100 Volts -100 Kv-a
Primary Exciting Winding 1100 Volts -75 Kv-a
Motor Insulation

Fig. 1.—"Chain Connected" Transformers to Produce 1,000,000 V.

block of wood placed in its path, part of the wood disappears and cannot be accounted for. A small hole is found through the block, not having the appearance of being burned out, and the wood surrounding it gives off a peculiar pungent odour. The portion of the wood which has disappeared, it has been suggested, may have been changed into another element, perhaps a gas. This opens up a great field for speculation.

The laboratory in which the tests were conducted is a large brick building, lined with steel to prevent any disturbances from reaching outside and causing possible damage. The room can be made dark and means have been provided for producing artificial rain from overhead. Every precaution is taken to safeguard the employés.

The tests determined that a tubular transmission cable 6½ in. in diameter would be necessary for a transmission line to work at this enormous pressure, and that transmission line towers 160 ft. high would be needed to carry the conductors spaced 30 ft. apart.

The artificial lightning is produced by releasing a high voltage that has been impounded in a large condenser; the latter rises 30 ft. above the floor and consists of 480 glass plates coated on both sides with tin foil, mounted in 48 cells. The condenser units are 15 ft. high, and are supported on glass post insulators about 15 ft. tall and 3 ft. in diameter at the base. The discharge points extend 18 ft. from the machine. Tests are made to show the effect of the discharge on wood blocks, oil, water, glass, and porcelain, such experiments being valuable in helping to solve the problem of insulation, and it was to secure a better understanding of such problems and also of corona loss that the apparatus was devised by Mr. F. W. Peek, Jr. The feat of producing, controlling, and releasing such amounts of electrical energy is no mean one, but the research engineers have gone further and are able to measure the shape of the resultant flash and determine its pressure.

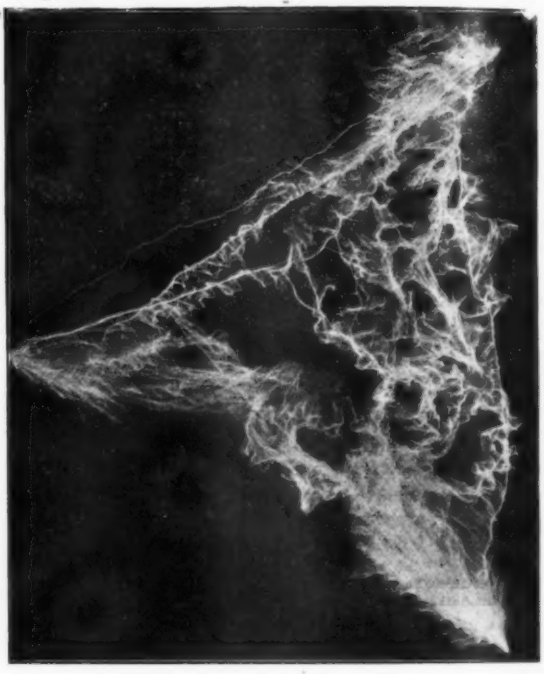

Fig. 3.—1,000,000-V, 9-ft., 3-phase Arc in Y-Delta.

The lightning arcs and corona discharges are photographed by means of glass and quartz lenses.

The glass lens, being opaque to ultra-violet rays, shuts off much of the corona but, being highly corrected, gives sharp definition. The quartz lens is transparent to ultra-violet rays, but being a simple lens cannot be corrected as with glass and gives a blurred effect. Since quartz has uniform optical constants, it is not possible to combine several grades to neutralise the principal aberrations as is done with glass. Even so, a quartz lens is something like five times as fast as glass and transmits perhaps a thousand times as much ultra-violet light,

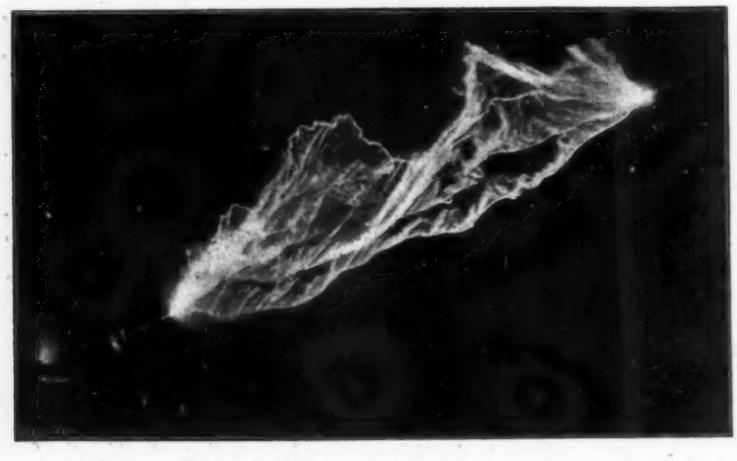

Fig 2.—60-cycle, 162-in. Arc Photographed through Quartz Lens.

Fig. 4.—Lightning Striking Miniature Village.

extending the effective spectrum over double the range of visible light.

The quartz lens was made from fused quartz produced by the Thomson Research Laboratory of the General Electric Co. at West Lynn.

At low voltages the difference in the appearance of the photographs taken through glass and quartz lenses is considerable; but it was supposed that the difference would be much greater at the higher voltages and this is borne out by photographs, which indicate that it is necessary to use a quartz lens in taking photographs of arc and corona phenomena if the whole effect is desired.

The million-volt, 3-phase outfit at the Pittsfield works of the G.E.C. was fully described in the October and November, 1922, issues of the A.I.E.E. *Journal*, and also in the December, 1922, and February, 1923, issues of the *General Electric Review*. The July, 1923, issue of the latter journal contains an informative article on e.h.p. testing transformers for central stations, and also a number of corona photographs taken with the aid of the above-mentioned outfit. It is pointed out that sometimes two 300,000-volt units are used in series with the neutral point earthed for obtaining 600,000 volts for testing strings of insulators, although pressures above 300,000 volts are more easily produced by the use of several 250,000-volt units in "chain connection," as illustrated in fig. 1. This arrangement has the advantage that operations may be begun with one 250,000-volt unit, and the capacity of the testing set may later be increased by the addition of one or more similar units to obtain 3-phase combinations or voltages to earth up to 1,000,000; thus eight 250,000-volt units could be operated in series with the neutral point earthed to give two million volts between lines.

L.C.C. TRAMWAY TRAFFIC CONTROL.

Direct Regulation by Telephone from Headquarters.

In view of the attention that is being devoted to London's traffic problems and the various schemes that are being suggested for the control of traffic in the metropolis, it is gratifying to be able to record that the London County Council Tramway Undertaking is actively engaged in minimising the possibilities of congestion. The latest step in this direction is the special system of telephones for the control of traffic which has recently been installed throughout the area north of the Thames. This area comprises approximately 23 square miles, extends from Hampstead to Poplar, and has approximately 53 miles of route.

Fig. 1.—A "Way" Station.

To run private telephone wires as ordinarily understood from all the various termini, junctions, and busy traffic centres in such an area to one central headquarters would be an undertaking equal to the complete telephone installation of a small town, and the number of wires necessary would cost a very considerable amount. The L.C.C. Tramway Department, however, has adopted a system, whereby one pair of wires may be used for a large number of telephones, which gives the facilities of an ordinary telephone service with the usual switchboard, but has in addition certain distinct advantages.

The scheme is based on the Western Electric Co.'s system of traffic control, and this company has been entrusted with the supply of the necessary apparatus and instruments. As indicated in our issue of July 20th, p. 116, the system is already extensively used by many of the large railways in this country and abroad, chiefly for the marshalling of goods traffic, and it has also been used on a small scale on tramways.

The outstanding feature of being able to use a number of instruments on one pair of wires running throughout the system is accomplished by a "selector" device which enables the controller to select and ring exclusively any one station out of as many as 78, if necessary. The number of stations connected to a pair of wires will, of course, vary according to the particular conditions, and in the case of the London tramways only about 36 points are so connected.

The headquarters for the control of the northern area is situated in the Council's car depôt at Hackney, and apparatus is provided there for four controllers, although at present the traffic is being handled by one controller only, with very occasional assistance.

Along the track at all important junctions, special selective telephones have been fitted in cast iron boxes mounted on the familiar feeder pillars, fig. 1. At each of these junctions a regulator is stationed who is responsible for the regulation and spacing of the cars in the district, and by means of the telephone he is in frequent communication with the controller at Hackney. As the latter is continually receiving reports from all the regulators, he is fully advised of all delays, breakdowns, accidents, or other unusual events occurring anywhere on the system.

The controller, by simply turning a particular key out of a number provided on his desk, fig. 2, can ring the bell of the telephone at any of the regulator or control points throughout the area, including various internal stations, such as car depôts, and power supply sub-stations. He is thus able to authorise the necessary action, send the breakdown gang, or summon assistance from other points; in fact, he is in complete control of the situation. When one considers the large number of minor incidents, such as, for instance, the breakdown of heavy lorries on the track—which, if not quickly removed, cause congestion not only to tramcars but to other traffic—it will be realised of what value it is for officials to be concentrated on the scene of a breakdown.

Briefly, the method of working the Western Electric telephone control system is as follows:—At intervals of half a mile, telephones are situated and an official, driver, or conductor, going to any one of these telephones has only to call into the mouthpiece "control," the message being conveyed through loud speakers in the control room to the controller, who, by means of a telephone jack, plugs in to the circuit from which the call is being received. The controller is also able, whilst taking the message, to ring another point, such as a breakdown gang, sub-station, or regulator, to whom

Fig. 2.—Control Room at Hackney.

it may be necessary to give instructions; even while he is talking, it is possible for him to ring a bell on the same circuit and call another man to the line.

The system is divided into eight circuits, which are at present linked in pairs giving four separate keyboards, each of which can be operated by a single controller, or the whole four by one controller. Usually the system is worked in this way, but if officials at two different points wish to hold a conversation their line can be isolated from the other seven for the time being, and through the loud speaker the controller is able to hear when the conversation ceases. The use of interconnecting switches has been much greater on this system than on any of the railway systems already installed.

PARLIAMENTARY NOTES.

(By our Special Parliamentary Reporter.)

Generators for Canada.—On July 24th, Mr. A. T. Davies asked the Parliamentary Secretary to the Overseas Trade Department whether he was aware that the General Electric Co. of Sweden had received important orders for generators for Canada; whether tenders for these supplies were placed in this country for the consideration of British manufacturers; and whether the Overseas Trade Department was kept informed of these contracts from British overseas dominions to foreign firms.

Lieut.-Colonel Buckley said he was aware that this Swedish company, which had an active organisation in Canada, had secured through its Toronto office an order for generators, transformers, and a switchboard, forming part of the electrical equipment required in connection with the Quinze River development scheme. The Department of Overseas trade drew the attention of a large number of United Kingdom manufacturers to the opportunity of competing for this contract. The department normally received information when such contracts were open to tender and of their eventual allocation.

Electricity Commissioners and Electrical Developments.—During the resumed debate on the Board of Trade Vote on July 26th the Electricity Commissioners were severely criticised. Sir Alfred Mond said that a very eminent and useful body was established when the Commission was set up, and it had been busily engaged in endeavouring to co-ordinate the whole system of electricity supply in the future; but, like many innovations of this character, it was having a retarding effect on operations at present and he was assured that there would be a great deal more business for the electrical industry to-day if, instead of so many inquiries being held, more decisions were come to, and people were allowed to place orders. He did not wish to criticise in any way the *personnel* of the Electricity Commission, but he thought their number was much too small to enable them to get through the vast amount of work which had to be done, and he also believed that the chairman should be a non-technical, and not a technical man, who would be less inclined to go into considerations of detail and more inclined to come to a decision. The speaker also referred to the question of railway electrification, the development of hydro-electric schemes, and especially the development of the tides. There seemed to be no reason why they should not develop a very large source of hydro-electric power in the direction of the Severn.

Mr. Ellis (Wakefield) agreed that they were suffering to a very large extent from either the inability or the inaction of the Electricity Commissioners, and especially was this the case in connection with electrical energy production in the West Riding of Yorkshire.

Mr. Gould urged the electrification of railways, docks, and harbours as a means of getting efficient and economical transport.

Sir P. Lloyd-Greame (President of the Board of Trade) indicated that the Trade Facilities and Exports Credits Acts would be extended, and said the Board had also sent a circular, in which the question of public works and electricity were raised, to all the local authorities, informing them that if they would put in hand works of a revenue-producing kind the Government would make an advance of 50 per cent. of the interest charges for a period of fifteen years in the case of a loan. They were also prepared to do the same thing for public companies carrying on the same class of work.

Smoke Abatement Bill.—On July 26th, Lord Onslow, in moving the second reading of the Smoke Abatement Bill in the House of Lords, said that the measure extended the Public Health Act, 1875; by providing that not only black smoke, but all smoke should be included in smoke nuisance, and that the term "smoke" should include soot, ash, grit, and gritty particles. Clause 1 enacted that Sec. 334 of the Act of 1875 should have effect as if there were included processes of re-heating and annealing, hardening, forging, converting and carburising iron and other metals. Clause 4 dealt with new buildings and empowered urban authorities to make by-laws requiring the provision in new buildings, other than private dwelling houses, of such arrangements for heating as were calculated to prevent or reduce the emission of smoke.

The Bill was read a second time.

Private Bill.—The Swanage Gas and Electricity Bill has been read the third time in the House of Commons.

London Electricity Supply Bill.—The second reading of this Bill in the House of Lords, which has been continually postponed, has now been put off until November.

The City and South London Railway Bill.—The Committee of the House of Lords dealing with this Bill re-opened the proceedings on July 25th. The chairman (Lord Beauchamp) said that the Committee's reasons for rejecting the original proposals (*vide* Elec. Rev., July 20th, p. 88) were based chiefly on financial considerations.

Mr. E. Shortt, K.C., for the City and South London Railway Co., said that the differences between his clients and the Southern Railway Co. had been composed. It had been agreed that the proposed extension, instead of being carried on to join the Wimbledon and Sutton Railway, should be cut short at North Morden, and the Southern Railway had agreed to withdraw its opposition, being satisfied that the scheme would benefit both parties.

Lord Ashfield then gave further evidence and explained the altered financial conditions resulting from the modification of the original scheme. The cost would be £3,600,000, nearly a million less than the original scheme, but the railway would serve immediately an area of denser traffic. Seven new stations would be constructed, and, judging by the circumstances attending similar stations, about 28,000,000 passengers would be dealt with per annum. An average fare of 4d. was assumed, making the annual revenue £466,000, plus miscellaneous receipts of about £20,000. The running expenses were calculated at £218,000 per annum, so that there should be a balance of £268,000. Against this, debenture interest (£180,000) would be debited, leaving a net margin of £88,000, instead of the £13,000 or £14,000 estimated for the original scheme. If there happened to be a deficit the Common Fund of the "Underground" group was in a position to meet it.

The Chairman expressed the Committee's satisfaction with the revised scheme and the Bill was approved as amended; it was read a third time and passed in the House of Lords on July 31st.

The London Electric Railway Bill.—The Unopposed Committee of the House of Lords, presided over by the Earl of Donoughmore, passed this Bill on July 24th, subject to any amendment that might be necessary as the result of the decision in the case of the City and South London Railway Bill. The London Electric Railway Bill provides for the extension of the Hampstead Tube from Charing Cross to connect up with the City and South London Railway at Kennington, and for other works. The Bill was read a third time and passed in the House of Lords on July 31st.

Committee on Canals.—At the House of Commons, on July 27th, a Parliamentary Committee, under the chairmanship of Sir J. Bruton, was formed to study questions relating to canals and inland waterway navigation. The Committee is representing to the Government the need for the development of this means of transport, and suggests that the object is one upon which public money could be profitably spent as a measure of unemployment relief.

CORRESPONDENCE.

Letters received by us **after 5 p.m. on Tuesday** *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Nation and its Inventors.

With regard to the article on the above subject in your issue of June 22nd, and Mr. T. E. Robertson's reply of July 20th, I notice that Mr. Robertson states that legislation has done handsomely for the inventor during the last 40 years, and has progressively reduced the cost of patenting; afforded protection against the abuse of monopoly rights; extended the duration of letters patent; prevented, as far as possible, the granting of worthless patents; and simplified procedure with a view to saving expense.

I think Mr. Robertson must have overlooked the fact that the United States Government patent fees amount to approximately £7 for 17 years, whereas the "well treated" British inventor is compelled to pay £131 for a period one year less than that granted in the United States.

Protection by means of letters patent is certainly given to the inventor, but the inventor has to bear the cost of any action against him for infringement, or has to take action at his own expense against anyone whom he thinks is infringing his patent. This in many cases prevents him taking advantage of the protection, and therefore the monopoly granted

can only be a protection provided the holder of such a monopoly is sufficiently wealthy to maintain it.

The Government did grant a period of two years' extension (for which the inventor has to pay £31) to cover the period of the war, but when it is borne in mind that the active period of the war was just over four years, and that trade has been upset ever since, the increase in the life of a patent seems to be totally inadequate.

Certainly the inventor can apply for an extension if he has suffered in consequence of the war, but the cost absolutely prohibits the majority of inventors from even thinking of it, in addition to which he still has to pay for the full period of the patent, in the majority of cases, before he can apply, unless he is in a position to risk £150-£200. (I am giving as a typical example the experience of one of the members of this Institute, at the end of the comments I am taking the liberty of making.)

It is well known that a very large percentage of the patents which are granted are, from a commercial point of view, absolutely valueless; in other words, they are worthless patents, and I can show to anyone who cares to call at the Institute's offices, by appointment, many patents which have been taken out and for which the inventor has paid, and in some cases probably mortgaged his hearth and home in his ignorance and his hopes of making a fortune. I am glad to state, however, that in this connection the Institute of Patentees has prevented many inventors from wasting time and money on valueless inventions.

I do not think that anybody who is a true Britisher could for a moment attack the British judiciary, which is certainly the finest institution in the world, but it must be remembered that the judges merely interpret the law, and if the law is not what it should be one cannot blame the judges; one can only blame those who are responsible for the law. The majority of inventors realise the great difficulties which the Patent Office has to meet with, and one continually hears of the courtesy and assistance which has been given to inventors; here again one cannot blame the department, one can only regret that the laws have been so framed.

As a typical instance of an injustice which the British inventor suffers I give, as stated, the experience of one of the members who took out patents in 1907, 1912, 1914, 1915, 1917. Up to the end of 1914 the member I refer to had paid £41 without making any profits. From 1915 to 1923, although practically no business was done and a considerable loss incurred, he had to pay £217. The total fees from the application for his first patent to the expiration of his last will amount to £655, and on the unexpired patents from 1923 to the expiration of the last patent a further £397 will be due. The inventor has, in consequence, been forced to cancel some of his patents and, while he will save fees, he will lose his patent, and there will be a loss of revenue to the Patent Office. In every case, in order to apply for the extension of the patents which are expiring, it would cost him approximately £150, and from a business point of view, and in view of the trade depression, he did not think it worth while.

I might state that he is a practical inventor of about 70 years of age, and he considers the patent laws appalling, and your correspondent, Mr. Robertson, must bear in mind that this inventor was 30 years of age when "legislation commenced to progressively reduce the cost of patenting." He states, and I concur, that the Patent Office should be a department of the State for the encouragement of the best inventive brains of the country, while safeguarding their interests.

I might add that since the outbreak of the war he has paid in renewal fees £207.

I fully agree with Mr. Robertson's closing remarks that in many cases inventions are patented which are only scientific novelties, and the inventor overlooks the fact that an invention, to be a success, must be a commercial proposition and it must be one which appeals to the business man, and as the business man has to exploit it, he must be able to make a profit as well as the inventor.

G. Drury Coleman,
Organising Secretary, Institute of Patentees.

London, *July 27th*, 1923.

LEGAL.

McCabe v. Storey.

In the King's Bench Divisional Court, Dublin, last week, before Mr. Justice Dodd, in connection with an intended action of Miss Anna McCabe, of Ballyroan, Rathfarnham, County Dublin, against Thomas W. Storey, a consulting engineer, Mr. Binchy, B.L., for the plaintiff, applied for an Order giving leave to serve a writ out of the jurisdiction on the defendant. The plaintiff, in an affidavit grounding the motion, stated that the defendant was indebted to her in the sum of £250. She had employed him as a consulting engineer to arrange for the repair of a battery in connection with the electric light plant at her residence at Rathfarnham. He informed her that the best quotation he could get for the necessary work amounted to £28 10s., and that the terms of the contract were cash with order. Subsequently the defendant informed her that he had paid the contractors for her and asked her for a cheque in recoupment. In response she sent him £150 on August 19th and £100 on September 17th, 1920, the two sums making £250, for which she was suing. The work had never been done. From inquiry which she caused to be made she found that the true cause of the delay was that the defendant, in fact, had never paid anything for her, or on her account, to the contractors, and that the statement upon which he had induced her to send him the £250 was untrue. The defendant had retained the £250 for his own use. He had repeatedly made and broken promises to settle the mater with her.

Mr. Justice Dodd granted the application.

The London Electricity Scheme.

The Court of Appeal, on July 27th, allowed the appeal of the London Electricity Joint Committee and others from the judgment of a Divisional Court discharging rules *nisi* of *certiorari* and prohibition which had been obtained against the Electricity Commissioners. The arguments were reported in our issue of July 20th (p. 88).

Lord Justice Bankes, in giving judgment, said that the Electricity Commissioners were a statutory body set up by the Electricity (Supply) Act, 1919, as the authority to whom a re-organisation of supply of electricity was entrusted. The Commissioners were the authority to approve or themselves to formulate schemes for the formation of electricity districts and the setting up of joint electricity authorities. The scheme to which objection was taken appeared at the present stage of its existence as a draft Order under Section 7 of the Act of 1919 constituting the London and Home Counties Electricity District and establishing and incorporating the London and Home Counties Joint Electricity Authority. The objection to that draft Order was that the Commissioners were travelling outside their Parliamentary powers and were acting without jurisdiction in putting forward for adoption the scheme in its present form. Whether there were any good and sufficient reasons from the point of view of the business interests of the objectors for taking the objection it was not for the Court to determine. The only question on that part of the case was whether the objection as to want of jurisdiction was made out. In his opinion it was and on this short ground. Section 6 (2) of the Act of 1919 enabled the Commissioners to formulate or to approve schemes which contained provisions for enabling the Joint Electricity Authority to delegate to Committees of the Authority any powers of the Authority. To get over objections made by the London County Council to having more than one district and more than one electricity authority for London and the Home Counties and the objections of the authorised undertakers within the district to having only one, the Commissioners had propounded this scheme, which, while in name providing for one electricity authority and for one district, in fact provided for two, each with its separate district and its independent powers. That was not, in his opinion, authorised by the Act of 1919. A further objection to the validity of the proposed scheme was that the power of delegation which by the Statute might be vested by a scheme in a joint electricity authority was by the present scheme exercised by the Electricity Commissioners themselves. His (his Lordship's) view of the construction of the Act of 1919 on that point was that whereas the Commissioners had the statutory right of determining where a power of delegation to committees should be conferred by a scheme upon a joint electricity authority, the statutory right of exercising that power, if conferred, was vested in the joint authority alone. Without going into other questions, he was of opinion that, on the grounds he had mentioned, the scheme proposed by the Electricity Commissioners was, to some extent, *ultra vires*. On the point which had been raised as to the effect of Section 26 of the Act of 1919 it was sufficient to say that he did not think that that section could be read as giving the Commissioners wider powers on the particular matters he had dealt with than those conferred upon them by the Act itself.

His Lordship then dealt at great length with the question whether the Court had any jurisdiction to make any Order for prohibition or *certiorari*. With regard to prohibition he thought, on the authorities, that the Court would issue the writ to a body exercising judicial functions, though that body could not be described as being in any ordinary sense a Court. The Act of 1919 imposed on the Commissioners very wide and very responsible duties and powers in reference to the approval or formulation of schemes. At every stage they were required to hold local inquiries to give interested parties the opportunity of being heard. Their authority extended to the creation of bodies who might exercise all or any of the powers of the authorised undertakers within the electricity district and to whom the undertakings themselves might be transferred on terms settled by the Commissioners.

The appeal against the Order of the Divisional Court discharging the rule *nisi* of a prohibition must be allowed with costs there and below and the rule for prohibition in the terms of the rule *nisi* must be made absolute. The appeal against the Order refusing to make the rule *nisi* for a *certiorari* absolute would be dismissed with costs.

The other members of the Court delivered judgment to the same effect.

BUSINESS NOTES.

Bankruptcy Proceedings.—Ernest W. Adams, commercial traveller (lately carrying on business as the Wireless Accessory Stores), 108, Canterbury Road, Old Kent Road, S.E.—Receiving order made July 21st on debtor's own petition. First meeting, August 8th. Public examination, November 28th, both at Carey Street, W.C.

Lawrence Backhouse, 23, Central Avenue, Prescot; C. H. Thornton, 18, Melbourne Street, Stretford; and Sydney Evans, 23, Royle Street, Seedley, Salford, carrying on business in partnership as the Arc Electrical Co., Victoria Street, Manchester. Receiving order made July 24th.

W. H. Vevers, builder and decorator, sanitary and electrical engineer, 91, King Street, Maidenhead. Trustee, Mr. W. Boniface, 10, Serjeants' Inn, Fleet Street, E.C.4, appointed July 23rd.

J. E. Rollinson, electrical engineer and contractor, Tavistock Chambers, Beastmarket Hill, Nottingham. Trustee released, May 25th.

H. J. W. Embury and K. S. Embury, trading as H. & K. Embury, 29 and 110, Queen Street, Newton Abbot.—Last day for receiving proofs for dividend, August 14th. Trustee, Mr. A. L. Honey, 23, Catherine Street, Exeter.

H. J. W. Embury (separate estate).—Last day for receiving proofs for dividend, August 14th. Trustee as above.

Thomas Davison, carrying on business at 30, Falkner Street, Liverpool, as the Radio Technical College.—Last day for receiving proofs for dividend, August 11th. Trustee, Mr. E. D. Symond, 11, Dale Street, Liverpool.

C. Wright & H. Wright, electrical engineers, 251, Fulham Road, S.W.—Trustee, Mr. W. Strachan, 50, Gresham Street, E.C., appointed July 24th.

P. Rothwell (trading with P. A. Rothwell, a minor, as P. A. Rothwell & Co.), electrical engineer, 64, Higher Bridge Street, Bolton.—Second and final instalment of composition of 1s. in the £, payable August 8th, at the Official Receiver's offices, Byrom Street, Manchester.

Company Liquidations.—British Wireless Supply Co., Ltd.—Winding up voluntarily. Liquidator, Mr. W. Adgie, Park Row, Leeds. Meeting of creditors, August 10th, at the Metropole Hotel, Leeds.

Calphos Electrical Co., Ltd.—Winding up vountarily. Liquidator, Mr. C. T. Payne, 80, Lancaster Road, West Norwood.

Ironclad Switchgear Co., Ltd. (In voluntary liquidation.)—Meeting of creditors, August 10th, at the Chartered Accountants' Hall, Spring Gardens, Manchester.

Meteor Manufacturing Co., Ltd.—Petition for the winding-up of the company presented July 5th; to be heard on August 8th.

Lowth & Smith.—Winding up voluntarily. Liquidator, Mr. J. McGregor, 4, St. Ann's Square, Manchester.

Bowns, Ltd.—Winding up voluntarily. Liquidator, Mr. J. W. Massey, 46, Cherry Street, Birmingham. Meeting of creditors, August 3rd, at above address.

Taunton Electric Traction Co., Ltd.—Winding up voluntarily (all creditors have been or will be paid in full). Liquidators, Mr. T. Bower and Mr. P. M. Rossdale. Meeting of creditors, August 10th, at 88, Kingsway, W.C.

Private Arrangements.—Mrs. Emily Louise Evans, trading as the Waterloo Electric Co., 129, Waterloo Road, London, S.E., and 73, New Cut, Lambeth, S.E., electrical factor.—The creditors interested herein were called together recently, when a statement of affairs was submitted which showed liabilities of £1,482, of which £1,481 was due to the trade, while there was a bank overdraft of £1 5s. 3d. The assets totalled £350, from which had to be deducted £87 for preferential claims, leaving net assets of £262, or a deficiency of £1,220. The assets consisted of: Stock-in-trade at cost £593, estimated to realise £300; and fixtures and fittings £83, valued at £50. It was stated that the stock consisted almost entirely of wireless goods, and £168 represented sets made up. No proper books of account had been kept. There were some books and during the 48 hours preceding the meeting every effort had been made to get them written up, which had to be done practically entirely from the pass books. The debtor started business in June, 1922, and the banking account was opened six weeks later. She stated that she paid into the business £270 at different times in the early days of the trading, which represented money she had saved. She was formerly employed as a demonstrator by a big wholesale firm and had made a good income. When she commenced business she took empty premises and the purchases for the period to date totalled £7,994, while the sales were £8,540. After crediting the present stock of £592 it appeared that there was a gross profit of about £1,140. Out of that the following payments had to be made: wages £530, advertising £912, rent £177, postage, &c. £142, trading expenses £37, bank charges, travelling and carriage £20, and insurance and telephone £17. The item for advertising was very considerable, as debtor had been advertising extensively in practically all the wireless periodicals. After making allowance for all those expenses there was a net loss of £690 for the period. There was a sum of £1,489 to be accounted for, having regard to the deficiency of £1,219 in the statement of affairs and the commencing capital of £270. As would be seen from the statement an amount of £325 had been written off the assets. In May, the debtor was at the Bristol Exhibition for three weeks, and the stall and expenses cost £150. Another "stunt" was the formation of a company in May last, but it was simply an empty shell. Debtor paid about £25 on account of the formation expenses, while the drawings were £224. The Waterloo Road shop was the one originally opened, and last March adjoining premises were taken over. A three years' agreement was running and debtor paid £50 for the tenancy and fixtures and fittings. With regard to the limited company, the main reason for the promotion was that Mrs. Evans thought she had an opportunity of obtaining capital for the business. In January, the cash book showed receipts of £94, while there was over £700 paid into the bank. In March, there was nothing in the cash book but over £600 paid into the bank. In April, £1,879 went into the bank while there was nothing entered in the cash book. The payments into the bank during June were only £60 and the trade seemed to have gone absolutely dead.

It was further stated that the debtor wished to continue the business and made an offer of a composition of 6s. 8d. in the £, payable by three instalments, while preferential claims amounting to £62 would be withdrawn. The debtor had been informed that one instalment of the composition would have to be guaranteed. Wireless was in its infancy, but the experience up to the present tended to show that it was a seasonal trade. They did not know what would happen in the autumn and whether there would be another boom. It was feared that if the creditors decided upon a realisation, the stock would have to be locked up and an attempt made to dispose of it in the autumn. If it was thrown upon the market at the present time it would probably not realise more than £200.

A creditor said he thought that an offer of 6s. 8d. in the £ was worth accepting. It was a great deal more than would be obtained if the estate was realised and manufacturers in the wireless trade did not want to take their goods back.

Mr. Clark, solicitor, who appeared for the debtor, said he thought the creditors should take it for granted at the moment that there was no security. The debtor had endeavoured to manufacture her own wireless goods and the experiments had resulted in a heavy loss.

Mr. W. A. J. Osborne, of Messrs. Corfield and Cripwell, accountants and auditors, remarked that the overhead expenses of the business were not heavy but the advertising expenses had been abnormal.

A creditor said it appeared that last winter the debtor was able to work up a wonderful turnover, and if given time the business could pull round.

Mr. Osborne: Yes, it has been a wonderful business, and the debtor has been taking as much as £400 to £500 a week.

The debtor was called into the room, and in answer to questions admitted that the books relating to the business were in a chaotic condition. She had been assisted in the business by her husband, who did the buying. She was the registered proprietor of the concern and the drawings for herself and her husband had only been about £4 per week.

A creditor said that although a great deal had been spent on advertising, it had helped to build up a goodwill for the business, and the effect of the advertising should be felt if the business was continued.

Eventually a resolution was passed in favour of the matter being dealt with under a deed of composition with Mr. Osborne as trustee and that a composition of 6s. 8d. in the £ should be accepted, payable by three instalments, the last secured to the satisfaction of the committee of the principal creditors.

The following are creditors:—

	£		£
Associated Newspapers, Ltd. ...	15	Radiogram Publishing Co. ...	30
Cassell & Co.	66	Radio Equipment Co.	25
Godfrey, A. & W.	12	Smith & Sons	22
General Electric Co., Ltd. ...	423	Siemens Bros. & Co.	67
Hightensite, Ltd.	14	Sterling Telephone and Electric Co.	158
Gent & Sons, Ltd.	57	Scheff Publicity Organisation ...	95
Jones, S., & Co.	23	Saunders Electric Co.	17
Kent Bros. and E. H. Phillips	52	South-Eastern Manufacturing Co.	22
Leach, S. G., & Co.	16	Three-Star Accumulators ...	29
Lile, J. H	37	Wates Bros.	100
Marshall, Percival, & Co. ...	42	Warrington Wire Rope Works ...	23
Mosses & Mitchell	40		

Percival Walter Stoodley, electrical engineer, trading as P. W. Stoodley & Co., 65, London Road, Camberley, Surrey. In response to a circular letter issued by E. T. Close, solicitor, 2, London Road, Camberley, a meeting of the creditors of the above was held on July 24th at Camberley. In the circular calling the meeting it was stated that the debtor, finding himself unable to meet his obligations as they became due, had executed a deed of assignment for the benefit of his creditors, under which Mr. E. J. Feilden, of Alpha Chambers, Alexandra Road, Farnborough, was trustee. The statement of affairs presented showed liabilities of £650, while the assets consisted of book debts £72 and stock and furniture £150, making total assets of £222, or a deficiency of £428. The trustee under the deed stated that he did not think the assets would realise much more than £140 at a forced sale and a resolution was passed confirming the deed already executed.

Dissolutions of Partnership.—F. Williams & Co., plumbers and electricians, Manchester.—Messrs. F. Williams and J. Hamnett have dissolved partnership. The business will be carried on and debts attended to by Mr. Hamnett.

Sparks & Cullen, motor engineers, electricians, &c., Langford.—Messrs. L. G. Sparks and C. H. Cullen have dissolved partnership. Mr. Cullen will carry on the business and attend to debts.

M. B. Macrae & Co., retailers of wireless instruments and accessories, formerly of Broadway Buildings, Reading, now at 12, Friar Street, Reading.—Mabel Byles, F. A. McDonnell and R. A. Etherington have dissolved partnership. Messrs. McDonnell and Etherington will attend to debts and continue the business under the same style.

Trade Announcement.—On August 7th the Underfeed Stoker Co., Ltd., is removing to Aldwych House, Aldwych, London, W.C.2. Telegraphic address: "Underfeed London"; Telephone numbers: "Central 4026, 4027, and 4028."

Catalogues and Lists.—The Telegraph Condenser Co., Ltd., Vauxhall Street, Kennington Oval, S.E.11.—A pamphlet giving capacities and sizes of condensers for radio purposes.

Sterling Telephone & Electric Co., Ltd., 210-212, Tottenham Court Road, W.1.—A priced and illustrated booklet (No. 361) containing details of radio receiving sets and accessories.

Messrs. A. Gallenkamp & Co., Ltd., 19 & 21, Sun Street, Finsbury Square, E.C.2.—List No. 81, giving prices of Bohemian glassware basins, beakers, flasks, &c.; Circular No. 28A, dealing with a laboratory water-bath; and Circular No. 34B, a price list of laboratory glassware.

Messrs. Smart & Brown, Erith, Kent.—A series of illustrated and priced pamphlets dealing with generating sets, centrifugal pumping sets, winches, marine engines, lathe attachments, &c.

Ozonair, Ltd., 96, Victoria Street, S.W.1.—An illustrated brochure describing the system of pure air ventilation installed on the Central London Railway.

Messrs. Ruston & Hornsby, Ltd., Lincoln.—Catalogue 447A, illustrating and describing "Ruston" vertical-type cold-starting oil engines.

Mr. Charles White, 5a, Fye Foot Lane, Queen Victoria Street, E.C.4.—A net trade price list of electric lighting, bell, and radio-telephone supplies.

Messrs. P. L. Dwyer & Co., 30, Grosvenor Place, S.W.1.—August price list of wires, cables, conduits, switchgear, and other electrical accessories. Also leaflets giving prices of lamps and radio-telephone sets and accessories.

The Cable Accessories Co., Ltd., Tividale, Tipton, Staffs.—Progress Sheet No. 66, giving particulars and prices of illuminated safety notices and directional signs.

The British Aluminium Co., Ltd., 109, Queen Victoria Street, E.C.4.—An illustrated brochure containing information regarding aluminium bus-bars and connections. Views of a number of typical installations are included, as well as a large amount of technical data.

Messrs. Norrington & Landon, Ltd., 33, Brazennose Street, Manchester.—Bulletin No. 202, containing illustrated details of mine and quarry equipment, including motors, switch- and fuse-gear, &c.

Messrs. Mather Bros., 35, 36, and 36A, Farringdon Street, E.C.—A telephone-number card, bearing illustrations of the firm's products—lift gear, arc lamps, telephones, &c.

British Empire Exhibition Notes.—The Halifax Tramways and Electricity Committee recommends, in response to the appeal of the E.D.A. for contributions towards the electrical display at the Exhibition, that Halifax should provide a sum on the basis of £2 per £1,000 of the department's annual revenue, the contribution to be spread over a period of two years.

It is announced that the Department of Scientific and Industrial Research has received a grant of £5,000 from the State for the purposes of an exhibit at Wembley relating to British science.

For Sale.—Radcliffe Urban District Council electricity department invites offers for one 120-kW Browett-Lindley, Mather & Platt steam dynamo set.

Warrington Electricity and Tramways Committee has for disposal one 100-kW Brush Co.'s motor alternator, with starters, &c. (See our advertisement pages to-day.)

Catalogues Wanted.—Mr. P. Fitzgerald, mechanical and electrical engineer, &c., of 1, Brighton Terrace, Queenstown, Ireland (late Executive Council, Irish Engineering Industrial Union), wishes to receive catalogues and price lists.

The Boilermakers' Lock-out.—In a circular issued by the Boilermakers' Society it is said that negotiations of all kinds with the Shipbuilding Employers' Federation and the Ministry of Labour are now at an end and preparations are being made for the continuance of the dispute through the autumn and winter, if necessary. A levy upon all employed members is being made at the rate of 1s. per week for ten weeks, and the lock-out benefit is being increased from 12s. to 15s. weekly. It is also stated that many of the society's members are waiting to enter the United States.

Foreign Exhibition.—United States.—The sixteenth annual New York Electrical and Industrial Exposition will be held at the Grand Central Palace from October 17th to October 27th. Radio apparatus, domestic household appliances, electric vehicles and accessories, industrial heating appliances, electrically-driven machinery, electric signs, and refrigerating equipment will be shown.—*Reuter's Trade Service* (New York).

Book Notices.—"Post Office Electrical Engineers' *Journal*." Vol. XVI; Part 2; July, 1923. London: Electrical Review, Ltd. Price 2s. net.

"China Year Book, 1923." Edited by H. G. W. Woodhead. London: Simpkin, Marshall, Hamilton, Kent & Co., Ltd. Price 35s. net.

"A Dictionary of Applied Physics." Edited by Sir Richard Glazebrook, K.C.B., D.Sc., F.R.S. Vol. V. Pp. vii+592. Illustrated. London: MacMillan & Co., Ltd. Price 63s. net.

"A Text-Book of Light." Edited by R. Wallace Stewart, D.Sc.London. Revised and enlarged by John Satterly, D.Sc., M.A., F.R.S.C. Pp. viii+362; figs. 210. London: University Tutorial Press, Ltd. Price 6s. 6d. net.

"The Ventilation of Public Buildings," by Robert Boyle. Pp. v+51. London: Robert Boyle & Son. Price 6s. net.—This little work consists of extracts from the reports of Royal Commissions and Select Committees on Ventilation, and from the speeches of other authorities. It is designed to show the superiority of natural over artificial methods of ventilation. Many examples of the former methods are illustrated.

Holidays.—The works and offices of the Dubilier Condenser Co. (1921), Ltd., will be closed from to-night until Monday, August 13th, for the annual holidays.

The Midland Electric Power Installation Co., of Wolverhampton, closes its works from the evening of Friday, August 3rd, until Monday, August 13th. Breakdowns or other emergency work will be attended to from the Birmingham office, 358, Gillott Road, Edgbaston. Telephone: "Edgbaston 891."

The works of the Jackson Electric Stove Co., Ltd., will be closed from this evening until Monday, August 13th, for the annual holiday.

Annual Outing.—The employés of Hightensite, Ltd., went to Southend for their annual outing on July 21st, the party numbering over 100. After luncheon, charabancs were waiting to take them on to Hockley Woods, where the annual sports took place. Tea was served there and the evening was occupied in dancing in the open, the party leaving at 9 p.m.

An "Arora" Campaign.—Following up the ideas ventilated at the Scarborough Convention of the I.M.E.A., the Arora Co., of Loughborough, has issued a circular letter to engineers interested in electric cooking, showing that it is prepared to adopt a bold policy in order to assist supply authorities in developing the domestic load. Particulars are given of the new patterns of "Arora" cooking and heating apparatus, and an extra 10 per cent. preferential discount is offered for sales of cookers for use in the houses of chairmen and vice-chairmen, as well as the very special terms of 50 per cent. off list prices in the case of apparatus for use by assistants. This concession should go far to promote the use of electrical apparatus by members of the station staff, which will enable them to speak from personal experience when they are explaining the advantages of the electrical way to consumers.

It is pointed out that the "Arora" firebars are now wound to a new specification, every spool of wire is tested before use, and the weight of wire in each spiral is nearly double that formerly employed, prolonging the life of the element. The oven at "high" takes 1,800 watts, and is heated to 360 deg. F. in 15 minutes; cooking operations can be carried on for 1¼ hours with the consumption of only 0.8 kWh. An important feature of the company's proposals is that it is prepared to enter into hire-purchase arrangements with customers of contractors or supply authorities; the retailer would receive the trade discount, and the purchaser would pay the total cost, plus 5 per cent., by instalments spread over a period of six months.

Telegraph Manufacturing in Ireland.—The *Cork Examiner* published the following last week:—"In view of the Government's decision to consider offers from home or foreign companies for the leasing or acquisition of Haulbowline, it is interesting to learn that the great concern of Siemens, Siemenstadt, Berlin, manufacturers of telegraph and telephone equipment, as well as general electrical apparatus, are taking soundings in Dublin at the moment. Amongst the Ministers approached are, I understand, the President and the Postmaster-General—the department of the latter Minister being intimately concerned with the lines manufactured by a firm like Siemens."

Lead.—In their statement, dated July 28th, Messrs. James Forster & Co. say:—"It appears to us that with the strike settled, very little lead will be wanted by consumers during August, so that, even given normal monthly imports (and the prospect is for heavy arrivals next month), there will be nothing to prevent prices slipping away, unless the market is artificially supported by locking up any excess supplies over requirements."

Applications for British Trade Marks.—The following are among the recent applications for British trade marks. Objections to any of them may be entered within one month of the dates mentioned :—

Pointolite. Nos. 425,778 and 425,779. Electric lamps in Classes 8 and 13 respectively. The Edison Swan Electric Co., Ltd., 123, Queen Victoria Street, London, E.C. July 25th, 1923.

Pharo Phone (lettering and design). No. 434,867. Class 8. Instruments and apparatus for use in wireless telegraphy and telephony. Neville L. R. Easton, trading as the Easton Radio Service, 6, Warwick Street, Regent Street, London, W. July 25th, 1923.

Dynaphone. No. 436,016. Class 8. Instruments and apparatus for use in wireless telegraphy and telephony. Charles M. Farquhar, Ridsdale Road, Anerley Station, London, S.E.10. July 25th, 1923.

Gramoless. No. 435,443. All goods in Class 8. Charles W. Ward, Brineton, Blumhills, Shifnal, Salop. July 25th, 1923.

Aurite. No. 437,344. Class 8. Detector crystals and detectors for use in wireless telegraphy and telephony. Edward J. V. Earle, trading as Vavasour Earle, Redhill Street, Regent's Park, London, N.W. July 25th, 1923.

Gladiator. No. 436,547. Class 8. Electric welding apparatus. Harold Pollock, 29, Corporation Street, Manchester. July 25th, 1923.

Electrical Mill Driving at the Consett Ironworks.—The English Electric Co., Ltd., has received from the Consett Iron Co. the order for the electrical equipment in connection with its new main mill drives. The mills to be electrified are : A 40-in. slabbing mill and a 42-in. plate mill, both of which will be driven by reversing motors with peak powers of 14,000 h.p. running at 50/100 revs.; a 32-in. light plate mill, which will be of the three-high type, driven by a 2,500-h.p., 3-phase induction motor, running at 240 r.p.m.; a Chequer plate mill, which will be driven by a 750-h.p. induction motor running at 240 r.p.m. The electrical equipment will be complete with the necessary flywheel sets for the reversing motors, switchgear, cables, &c. It is believed that this order represents the most important rolling mill installation contract which has been placed in this country in recent years.

A Belgian Manufacturing Co.—The report of the Constructions Electriques de Belgique, dealing with the year ended on April 30th, 1923, states that the results were unfavourably influenced by a strike at the company's Ghent works, as well as by the re-organisation of the works at Liége. In addition the industrial crisis reacted on the turnover; the costs of production increased owing to the decline in the turnover on the one hand and the advance in the prices of raw materials on the other. It was impossible to obtain compensation for the higher costs of production by a corresponding increase in sale prices as a consequence particularly of the competition of foreign firms who succeeded in combating the influence of their high exchange by making sacrifices in prices in order to develop their export trade. The accounts show a loss of 555,000 fr. for the year on a share capital of 40,000,000 fr.

The Russian Electrical Industry.—On June 1st some 26 electric works employing 14,083 workmen were in operation, says the *Ost Express*. These works are combined into four trusts, namely :—The Electric Trust of the Central Regions (ETZR), the (Petrograd) Electric Machinery Trust (Elmaitrust), the Weak-current Trust, and the Accumulator Union. Three isolated works are placed under the direct control of the Central Electricity Administration (Glavelektro). The total value of the production in May amounted to 2.47 million gold roubles, or 113 per cent. of the production in April. The share of the ETZR amounted to 1.23 million gold roubles. The cable industry showed no improvement, while the work of erecting machinery reached considerable dimensions. The Petrograd Elmaitrust produced goods valued at 899,000 gold roubles; this trust is specially employed on the manufacture of large machinery for Russian electrification enterprises. Particularly noticeable is the producing capacity of the electric lamp works. The Weak-current Trust produced a considerable amount of apparatus for the radio industry, and manufactured during May goods worth 240,000 gold roubles. The value of the Accumulator Trust's production was 62,000 gold roubles, and that of the three isolated works 37,000 gold roubles.—*Reuter's Trade Service* (Moscow).

The electric lamp production of the Central District, which is confined to three factories in Moscow—the Pokroff, the Meschtchansk, and the Kudrinsk—will soon be reinforced by another, an existing building having been adapted for the purpose. Machinery and automatic apparatus will be largely used, the latter having been already ordered from America, with a capacity of 10,000 lamps of the normal "economic" type a day.

Copper and Lead Prices.—Messrs. F. Smith & Co. report July 31st :—Copper (electrolytic) bars, £72 15s., 5s. decrease; do. do. sheets, no change; do. do. wire rods, £82 15s., 5s. decrease; do. do. h.c. wire, no change.

Messrs. James & Shakespeare report August 1st :—Copper bars (best selected), sheet and rod, no change; English pig lead, £25 15s., 5s. decrease on last week's quotation.

"Celastoid."—In an article on "Commercial Piezo-Electricity," which appeared in our issue of February 23rd, 1923, reference was made to "compressed cellulose acetate, known commercially as 'celastoid.'" We are informed that the word "Celastoid" is in no sense a common commercial name, as might be thought, but is the registered trade mark of the British Cellulose and Chemical Manufacturing Co., Ltd., which is the sole owner of this trade mark.

Austrian Trade with Russia.—The Government of the Soviets is reported to have confirmed the statutes of a joint Austro-Russian trading company under the title of the Russavtorg, in which the former will hold one half of the share capital. Among the Austrian firms participating in the new company, most of which are said to belong to the group of the Anglo Bank and to be supported by English capital, were mentioned the Ellin Electrical Industry Company and the Styrian Arms Co.

Railway Charges.—Among the further reductions in charges by passenger train which became effective as from August 1st were the following :—Rates for heavy castings and similar consignments conveyed in a special truck reduced from 10½d. per ton per mile to 9d. per ton per mile, station to station, owner's risk. No less charge than as for 1 ton. Minimum, 30s. 25 per cent. extra at company's risk.

LIGHTING AND POWER NOTES.

Accrington.—Year's Working.—The accounts of the borough electricity undertaking (engineer : Mr. A. W. Clegg) for the year ended March 31st last, record a total income of £81,377 and an expenditure upon revenue account of £35,345, leaving a gross profit of £46,032. In 1921-22 the figures were :—Revenue, £80,225; expenditure, £45,548; gross profit, £34,677. Capital charges remained at about the same level, and the net profit was increased from £13,790 to £23,124. The payment of a sum expended for capital purposes and the part extinction of a debtor balance brought forward, left a deficit of £3,392 to be carried to the next account. The capital expenditure (including £2,387 from revenue) amounted to £64,751 during the year. The principal items were turbines, boilers, and switchgear. The number of kWh sold during the year was 9,773,591, as compared with 7,946,852 in the previous year; the chief increase occurred in energy sold for power purposes.

Aldershot.—Electricity Charges.—The Town Council has applied to the Ministry of Transport for an Order to retain the existing maximum charge of 10d. per kWh, with minimum payments of 12s. 6d. for each winter quarter and 8s. 4d. for each summer quarter.

Andover.—Revocation of Order.—The Minister of Transport has revoked the Andover Electric Lighting Order, 1915, as to the whole of the area of supply as from July 31st.

Argentina.—Rosario.—The report of the Société d'Electricité de Rosario, a Belgian undertaking, states that during the past year the out put of the company's power station was 38,273,500 kWh, as compared with 34,779,200 kWh in 1921. In order to meet the increasing demand, the boiler house at the Scrrento generating station is being enlarged, and it is also proposed to install an additional 12,000-15,000-kW turbo-alternator.

Bexhill.—Year's Working.—The report of the Electrical engineer (Mr. C. A. Frost) for the year ended March 31st, 1923, shows that the total income of the undertaking was £29,210, as compared with £29,180 in the preceding year. Working expenses amounted to £15,796, as against £18,960, leaving a gross profit of £13,245 (£10,154). After the payment of loan interest, sinking fund instalment, &c., there remained a net profit (before providing for income tax) of £5,942, as compared with £3,131 in the previous year. Income tax required £910. £8,382 was expended on capital account during the year, machinery absorbing £5,420 and mains and services £1,879. The sales of energy rose from 883,364 to 1,037,82[illegible] kWh, and the maximum demand from 750 to 810 kW.

Chester.—Electricity Supply.—Important electrical changes are pending in Cheshire, following the Council's adoption last week of a report by the city electrical engineer (Mr. S. E. Britton). When the transformers and switchgear now on order, are installed, they will complete two independent lines for the transmission of electricity from the power station at Queensferry to the New Crane Street works at Chester. The steam generating plant at New Crane Street will then no longer be required for stand-by purposes, and it is intended to dispose of most of the generating plant and convert this works into a sub-station for the distribution of electricity. The old plant will realise about £3,500. The total cost of all the generating plant was £36,724, of which £32,969 has already been repaid. The cost of carrying out certain proposed work is £13,706, after allowing for the sale of generating plant. Application is to be made to the Electricity Commission for sanction to the borrowing of £13,250 for the purchase of machinery and transmission lines.

Brighton.—Year's Working.—The total income of the electricity undertaking (engineer: Mr. J. Christie) during 1922-23 was £188,161, as compared with £206,213 in the previous year. The working expenses were reduced from £144,885 to £122,017, increasing the gross profit from £61,328 to £66,144. The capital charges (including £4,935 spent out of revenue for capital purposes) were slightly higher, but the net profit at £27,898 showed an increase of about £4,000. To this balance was added £32,383 brought forward, and the total sum (£60,281) was distributed as follows:—Applied in aid of district rate, £8,000; transferred to reserve, £24,383; balance carried forward, £27,898. The capital account records a total expenditure of £65,519 principally for machinery and plant (£56,169), and mains (£8,233). The energy sold during the year amounted to 13,329,706 kWh, as compared with 11,408,093 kWh in 1921-22. The maximum load rose from 7,600 to 8,700 kW, while the generating capacity remained statiqnary at 12,500 kW.

Canada.—Hydro-Electric Development.—According to the *Electrical News*, of Toronto, the British Columbia Electric Railway Co. is proceeding with a scheme for the development of 115,000 h.p. on the Stave River. It is proposed to erect two power stations, one on Stave Lake, with a capacity of 10,000 h.p., and the other three miles below the company's Stave Falls station, which will develop 80,000 h.p. It is also intended to install additional plant at its Stave Falls station with a capacity of 25,000 h.p. The work will extend over a period of from five to ten years, and the estimated cost is $10,000,000.

Cardiff.—Breakdown.—A breakdown at the power station recently held up the tramcars for more than an hour. Temporary arrangements for a supply of electricity, except to the tramways, was made in about 15 minutes.

Continental.—Russia.—During the war the already defective power station at Ekaterinburg became practically useless, and is now only running by virtue of some partial repairs effected last year. In any case it is too small, and a new one is to be erected of 10,000-kW capacity. The cost is estimated at 2,000,000 roubles.

The Elektromaschine Constructional Trust has an order to equip a large new hydro-electric station in the Samursk district to serve the Baku petroleum industry. Its capacity will be about 40,000 h.p. The energy will be transmitted to a distance of 175 km.

Dorchester.—New Plant.—The Town Council has decided to install a 100-kW vertical 4-cylinder gas engine and gas producer at the electricity works at a cost of £2,830.

Epsom.—Loan.—The Urban Council has applied to the Electricity Commissioners for sanction to a loan of £5,506 for the installation of an engine and dynamo, extensions to buildings, switchboard, &c.

Horwich.—Special Order.—The Electricity Commissioners have submitted a Special Order, authorising the Urban District Council to supply electricity, to the Minister of Transport for confirmation.

Ilford.—Electricity Supply.—The Urban Council has decided to supply electricity to the tramways at 1½d. per kWh. Action on a proposed agreement to take a bulk supply of electricity from West Ham has been deferred until September. It is stated that the Electricity Commissioners will not approve any further extension of the generating plant at Ilford.

India.—Maymyo.—An electric power station has recently been completed in Maymyo, Burma, and the opening ceremony was performed by the Governor of Burma. In the course of a speech, his Excellency mentioned that electricity would shortly be available in 29 other towns in the province.

Ipswich.—Year's Working.—The chief engineer and manager of the electricity department (Mr. A. S. Black) reports that the total revenue during the year ended March 31st last was £82,188, a slight reduction as compared with that of the previous year (£83,489). Working expenses fell from £55,481 to £44,874, leaving a gross profit of £37,314 (£38,008). Although the capital charges increased to a small extent, a balance of £27,069 was carried to the appropriation account, as compared with £17,934 in 1921-22. The balance was disposed of as follows:—Debt redemption, £16,268; contributed to capital expenditure, £831; transferred to reserve, £9,970. A total of £15,286 was spent on capital account during the year. It is noted in the report that the accounts are subject to audit. The sales of energy rose from 4,906,830 to 5,750,151 kWh and the maximum demand from 3,382 to 3,867 kW.

Irish Free State.—Blackrock (Dublin).—The Urban Council scheme for lighting the town by electricity is likely to be taken over by a company. It is understood that the Government will sanction the amended scheme under certain conditions.

Liffey Hydro-Electric Scheme.—The recommendations of the Dublin Electricity and Public Lighting Committee, based on the report of Mr. J. Buchi, have now been adopted by the Municipal Council. A conference of all power users in Dublin and district is to be called to ascertain the extent to which they will be prepared to co-operate for the carrying through of the project. The capital cost of the scheme is £1,130,000, made up as follows:—Ballymore works, with reservoir, £740,000; Leixlip works, with reservoir, £270,000; transmission lines, £120,000. The cost per kWh of energy supplied from Dolphin's Barn transformer station is estimated at: Water power, 41,500,000 kWh, 0.57d. per kWh; water power, plus steam (for peak load), 51,000,000 kWh, 0.74d. per kWh. —*Irish Builder and Engineer.*

Keighley.—Electricity Agreement.—An agreement was reached last week between the Corporation and the Yorkshire Electric Power Co., whereby the Corporation Electricity Department will supply electricity in bulk to the Yorkshire Power Co. at Eastburn sub-station, and the company will transmit a supply to the Skipton Urban Council. The agreement with Skipton Council provides for a minimum payment of £1,125, the Keighley Corporation to erect and maintain the transmission line from Eastburn to Skipton. The agreement with the company provides for a minimum payment of £625, and for the line to be erected and maintained by the company. The prices of 6d. per kWh and the coal-price clause are the same in both agreements. The company is not entitled to supply energy obtained from Keighley to any consumer other than Skipton, except by special arrangement with the Corporation. The maximum demand is 250 kW. The Keighley Corporation undertakes to maintain the line from Keighley to Eastburn; any increase beyond 250 kW must be the subject of a new agreement. No provision is made at present for the possible supply of electricity to the districts between Keighley and Skipton.

Leicester.—Special Order.—The Council is applying to the Electricity Commissioners for a Special Order empowering it to extend its area of supply so as to include a number of parishes and townships.

London.—Electricity Charges.—The Highways Committee of the London County Council reports that it has received a letter from a consumer in the Notting Hill Electric Lighting Co.'s area, asking the Council to take steps to secure a reduction in the charges of the company. The Committee points out that a reduction has already been made in the charges, making them, since January 1st, as follows:—Lighting, 7d. per kWh; power, 2½d. per kWh (special contracts, 2d.); and heating, 3d. per kWh. The return to the shareholders on the whole of the capital invested has nevertheless risen from 16.58 to 18.57 per cent., representing a charge of 1½d. per kWh to the consumer, which cannot but be regarded as excessive. In 1921 the average revenue per kWh received by the company was 6.6d., of which 2.03d., or 31 per cent., represented the charge for dividends and interest. Each of these figures was higher than the corresponding figure in respect of any other London company.

The charges of the County of London Electric Supply Co., Ltd., have also been considered, and it is stated that, although the general rate for lighting (8d.) is not exceeded by any of the other London companies, the company's *average* price per kWh is one of the lowest in London. The ordinary dividend represents only a third of a penny per kWh, but the last contribution to the general reserve alone amounts to 1d. per kWh. Both companies, it is recommended, should be asked if any further reductions in charges are contemplated by them.

St. Pancras.—The Finance Committee has recommended that application be made to the London County Council for the advance of £44,585 for electricity purposes.

The Electricity Commissioners have sanctioned the borrowing of £8,794 for services, meters, &c., and £70,255 for two boilers, one 5,500-kW turbine, and building work.

St. Marylebone.—*Street Lighting Improvement.*—The Works Committee has drawn up a scheme for the improvement of the lighting in a number of the principal streets in the borough. It is proposed to erect tubular steel standards fitted with divided cast-iron bases for the switchgear. The lamps will be of the 500-W size on double brackets and 750-W on single brackets, at a height of 25 ft. from the ground. The standards will be 50 or 60 yd. apart. The estimated net cost of the scheme is £16,070, and the extra annual charge £1,374. It is recommended that sanction be sought to a loan for this purpose.

Circulating-water Discharge.—The Electricity Supply Committee proposes to extend the discharge circulating water main to the Regent's Canal. This will involve the taking over of a 33-in. pipe line 960 ft. in length from the Central Electric Supply Co., Ltd., at a cost of £2,500; the provision of a new intake dock and pipe line extensions costing £2,539; and new pipework (£779). An amount of £3,500 has already been approved for a shorter extension, which will be superseded by the new proposals.

"Free" Wiring.—A scheme of "free" wiring has been put forward by the Electric Supply Committee. The property which it is proposed to wire, recovering the cost by an extra charge for electricity, consists of 491 one-room, 1,127 two-room, 749 three-room, and 454 four-room tenements, and it is estimated that the initial cost will be £5,500. A revenue of £1,600 per annum is considered possible. It is proposed that the work shall be carried out by local contractors, who will be asked to tender. Sanction is to be sought for the borrowing of the necessary funds.

Morecambe.—Extensions.—It was reported at a recent meeting of the Town Council that the Electricity Commissioners saw no objection to various works in connection with

the electricity undertaking being put in hand, but they could not at present give formal sanction to the borrowing of £43,000. The Commissioners were also willing to consider favourably the proposed agreement between the Morecambe and Lancaster Corporations regarding the joint electricity scheme.

Newcastle-under-Lyme. — Year's Working.—The draft statement of accounts of the municipal electricity undertaking (engineer: Mr. A. J. C. de Renzi) for the year ended March 31st last, shows a total revenue of £9,599, as compared with £8,697 in the previous year. Working expenses amounted to £4,708, as against £4,641, leaving a gross profit of £4,891 (£4,056). After charging loan interest, &c., a net profit of £1,074 remained, as compared with £995 in 1921-22. The number of kWh sold was 411,803, as against 325,501.

North Wales.—Hydro-Electric Development.—With regard to the article in our issue of July 6th on the Colwyn Bay undertaking, we are informed that the development of the water-power resources in the extreme western area is to be immediately proceeded with. The area concerned is known as the Maentwyog scheme, and the average rainfall on the watershed is 93 in. per annum. For the purpose in view, the Electricity Commissioners have sanctioned a loan of over £1,000,000. Before the Llandudno inquiry in 1921, it was stated that the outlay on new works would be, for 1923, £1,380,000, and for 1924, £1,648,300. In view of the present wasteful method of drawing the portable water from lakes at over 1,000 ft. above o.d., conveying it down to reducing-pressure tanks at an elevation of about 500 ft. above o.d., it is proposed to "normalise" power and portable water supplies by utilising all the available hydraulic head above about 500 ft. for power (hydro-electric supplies), catch the tail waters in adequate reservoirs at 500 ft. above o.d., making use of this head for public water supplies, and any surplus for power purposes a few feet above o.d. Mr. T. Vaughan Hughes claims to have advocated this procedure in the local Press over three years ago.

Salford.—Loan.—The Electricity Committee has recommended that application be made to the Electricity Commissioners for sanction to the borrowing of £76,973 for mains, services, and sub-station plant in the Salford and Prestwich districts.

Sherborne.—Special Order.—The Special Order granted to the Sherborne Electric Supply Co., Ltd., has been submitted by the Electricity Commissioners to the Minister of Transport for confirmation.

Shrewsbury.—Year's Working.—The total income of the electricity undertaking for the past year amounted to £23,286 and working expenses to £13,636, leaving a gross profit of £9,650. After payment of interest on loans and sinking fund contribution there was a net profit of £5,387.

South Mimms.—Electricity Supply.—The Rural District Council has applied to the North Metropolitan Electric Supply Co. for the terms upon which it would be willing to give a supply to the district and Potters Bar.

United States.—Hydro-Electric Development.—Work on the first section of the Skagit River hydro-electric scheme is nearing completion, and it will be brought into use towards the end of the year. Two generating sets of 20,000 kVA each will be installed at first, and a third set of 30,000 kVA will be added later as the demand for electrical energy increases. A 165,000-V transmission line and sub-station are now under construction. A dam is to be constructed about 10 miles from the George power house on the Skagit River, with a storage of 1,300,000 acre-ft. A power station will be erected below the dam with six 45,000-kVA generating sets. The estimated cost of the whole scheme is $57,000,000.

Walton-on-Thames.—Proposed Transfer of Undertaking.—The Urban Council has adopted a recommendation by the Electric Lighting Committee to obtain preliminary expert advice with reference to the Council's taking over the undertaking of the company which operates in the district.

Wellingborough.—Electricity Orders.—The Rural Council has decided to offer no objection to the applications of the Wellingborough Electricity Supply Co., Ltd., and the Rushden Electricity Co., for Orders to extend their areas of supply so as to include parishes in the Council's area.

Worthing.—Extensions.—The Town Council has decided to extend the electricity works at an estimated cost of £8,170.

TRAMWAY AND RAILWAY NOTES.

Croydon.—Railless Cars.—The Borough Council has decided to adopt a railless-car system on the Addiscombe route, which is to be reconstructed at an estimated cost of £110,000.

Edinburgh.—New Routes.—The Tramways Committee proposes to construct new tramways to Willowbrae in preference to running tramcars along Northfield Broadway.

The Musselburgh and District Tramways Co. has applied for permission to construct loop lines near Ravenshaugh, and the East Lothian Western District Committee has referred the matter to a small sub-committee to confer with the Tramways Committee.

Glasgow.—Transfer of Paisley Undertaking.—The Glasgow Corporation Order having received the Royal Assent, the Paisley tramways were taken over by the Corporation on August 1st.

Electrification of Subway.—Electrification of the Glasgow Subway Railway, the Cathcart circle, and several other local railway routes is suggested as a means of providing work for unemployed in the city. Regarding the subway, which was formally taken over by the Corporation on August 1st, it is stated that one or two firms of engineering contractors have already been invited to submit schemes.

Hull.—New Routes.—Extensions to the tramways, involving an estimated expenditure of £130,000, are proposed by the Tramways Committee. It is intended to construct tramways from Anlaby Road to Pickering Lane, along Spring Bank West, *via* Jameson Lane to Anlaby Road, from Anlaby Road terminus through Hawthorn Avenue to Hessle Road, from Spring Bank West to Cottingham Road, *via* Charterlands Avenue, from the Training College, Cottingham Road, in the direction of Cottingham, as far as the city boundary, from Beverley Road to Endyke Lane, and from Holderness Road to Sutton Lane.

Ipswich.—Year's Working.—The accounts of the tramway undertaking for the year ended March 31st last (subject to audit) show a total income of £43,299, as compared with £44,528 in the previous year. Against this was charged a working expenditure of £39,420 (£44,735), leaving a gross profit of £3,879, which compared favourably with a deficit of £207 in the preceding year. After charging bank interest and interest on loans, a balance of £25 was carried to the appropriation account. To this was added £6,880 from the borough fund, and the total sum was used for debt redemption and to meet a previous deficit of £1,119, leaving a balance of £2,568 to be carried forward. The car-mileage increased from 550,703 to 577,493, but the number of passengers carried was reduced from 5,552,849 to 5,541,339.

London.—L.C.C. Tramways.—The Highways Committee of the London County Council has decided to prepare drawings and estimates for the installation of a new 15,000-kW turbo-generator set at the Greenwich power station. This will replace four existing 5,000-kW sets, one of which will be disposed of, the other three remaining as spare plant.

Torquay.—Light Railway.—The Corporation is applying for an Order authorising it to construct and maintain a light railway in the borough and the parish of Marychurch, and to enter into agreements with the Torquay Tramways Co., Ltd., and others, for the construction, working, maintenance, and leasing of the railway.

TELEGRAPH & TELEPHONE NOTES.

Italy.—Rome-New York Cable.—A contract has been signed at New York between the Western Union Telegraph Co. and the Italian Submarine Cable Co., under which the latter company undertakes to lay a cable between Rome and the Azores, and the former to lay one between New York and the Azores, where it will be connected with the Italian line. There has been some delay in securing landing rights at the Azores from the Portuguese Government, but it is expected that these will be obtained in the near future; if not, another joint station will be decided upon by the cable companies.—*Reuter.*

Morocco.—Telephone Service.—The Swedish Telephone Co., L. M. Ericsson, has built a new telephone station and a complete system at Tangier, all electrical materials, and even wooden poles, being delivered from Sweden.—*Evening News.*

Uruguay.—Underground Telephone Cables.—The municipality of Montevideo has decided to lay a network of underground telephone circuits throughout the city and the work will shortly be started.—*Financial Times.*

RADIO-TELEGRAPHY AND TELEPHONY.

Japan.—International Radio Stations.—The Japanese Premier announced on July 27th the Government's decision to permit private companies to erect and operate under specified conditions international radio stations and to subsidise them as occasion demands.—*Financier.*

Radio-Broadcasting.—Royalties.—The British Broadcasting Co. has agreed with the Performing Rights Society, which represents composers, authors, and publishers, to pay royalties for copyright songs and music which it broadcasts. Payment will be retrospective.—*Evening News.*

THE CABLE STEAMER "FARADAY."

Messrs. Siemens Brothers' New Vessel.

In the course of the next few days three cable-laying ships will set sail with the object of laying a new submarine telegraph cable for the Commercial Cable Co. between Waterville, in Ireland, and Canso, in Nova Scotia. The operation is expected to take three weeks, and is estimated to cost just over £3,000,000. One ship will carry the deep-sea section of the cable and the other two will lay the shore-ends. It is hoped that the new cable will be working direct between London and New York early in August; it has been designed for high-speed operation, being guaranteed to work at the rate of 600 words per minute in both directions, and to that end its copper conductor has been made much heavier than is usual for such class of cable.

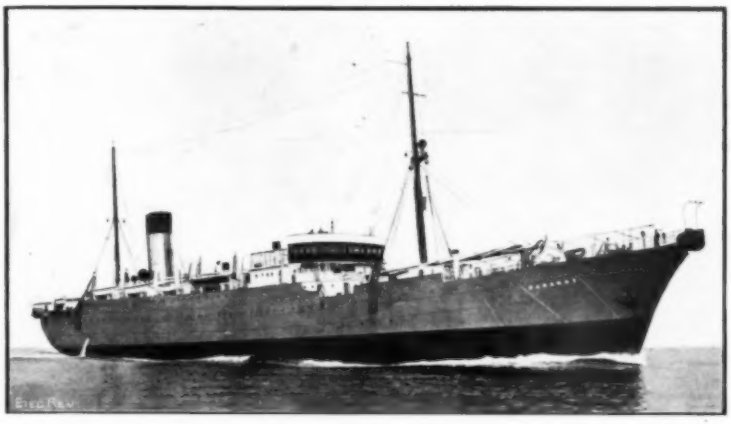

Fig. 1.—The New c.s. "Faraday."

For the past three months the Telegraph Construction and Maintenance Co., Ltd., and Messrs. Siemens Bros. and Co., Ltd., have been engaged upon the manufacture of the cable, and Messrs. Siemens' new c.s. *Faraday* is now in the Thames, off the company's Woolwich works, loading 1,000 miles of submarine telegraph cable—weighing in all over 4,000 tons—for the Commercial Cable Co., and in a few days' time she will proceed on her maiden voyage to lay the portion of the cable between New York and Fox Bay, Nova Scotia. The cable is insulated with gutta percha, and the weight of the copper conductor is 450 lb. per nautical mile.

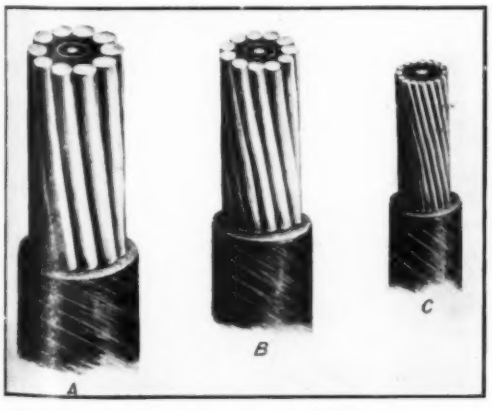

Fig. 2.—Submarine Cable.

The armouring is of eight different types, this being rendered necessary by the varying depths of water between the points to be connected, and also by the fact that a large portion of the route is over fishing areas where the cable is liable to be disturbed by ships' anchors, &c.

The cable is illustrated in fig. 2, A being the shore end, B the intermediate cable, and C the deep-sea portion.

Captain A. D. Gange, skipper of the old *Faraday*, is in command of the new vessel, and Mr. A. J. Stopher, who sailed for over 30 years in the old ship as her owners' chief technical cable-laying engineer, will also sail in the new ship on her first voyage.

The new c.s. *Faraday*, which we had the pleasure of visiting last week, is one of the largest and most modern vessels of her type afloat; she is capable of carrying about 4,500 tons of cable; has a steaming radius of 10,000 miles; and is fully equipped with up-to-date appliances for laying and repairing submarine cable. Her leading dimensions and other details were outlined in our issue of March 2nd this year.

The vessel has a clipper stem adapted for carrying three cable sheaves, a cruiser stern with two sheaves fitted on the starboard side, two schooner-rigged masts, a double bottom fore and aft with an oil-tight division, adapted for carrying either water ballast or oil fuel. Siemens electrical distance thermometers are installed at six different points in the fuel oil tank, by means of which a continuous record of the variations of temperature can be obtained.

There are four cable tanks, each having a watertight steel cone, and a large hold forward is provided for stowing buoys and other gear incidental to cable work. The ship has two complete decks, designated shelter and upper respectively; above the former is a long boat deck, and there is also another deck beneath the upper deck outside the limits of the machinery space. On the boat deck at the forward end is a large steel house containing a suite of rooms each for the captain, cable engineer, and cable representative, and also a drawing office; above this house is the navigating bridge, with a chart room and special rooms for the captain and the navigating officer, contained within the teak and glazed encasement. The total number of ship's officers, cable staff, and crew will exceed 150. There are five lifeboats, two working boats, and two motor lifeboats, with patent mechanical davits to each.

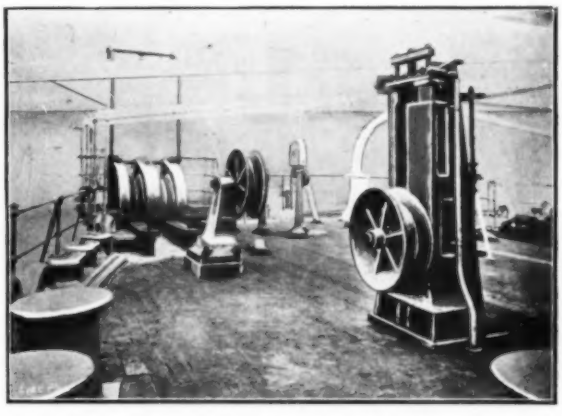

Fig. 3.—After Deck; Dynamometer and Stern Sheaves.

The shelter deck is the working platform for cable

repairing, testing, jointing, &c.; at the bow are three cable sheaves. Immediately forward of the main cable machinery hatch is a dynamometer for registering the pull of the cable, and abaft this hatch is a steel house and shelter for the control gear of the picking-up machinery.

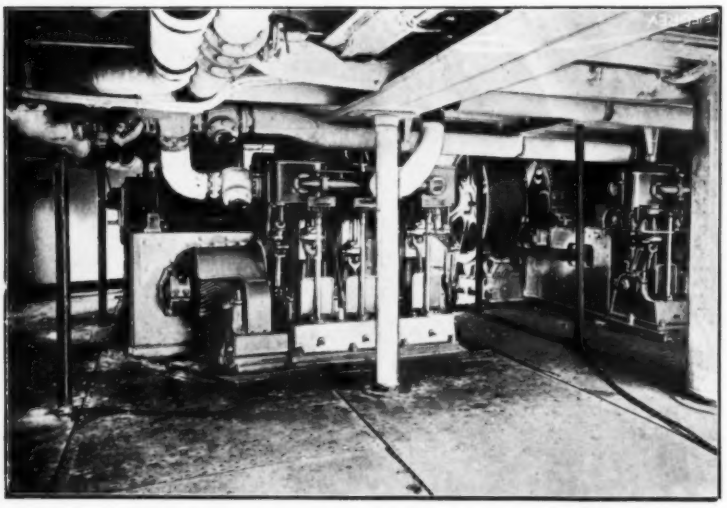

Fig. 4.—Main Deck; Picking-up Machine.

Situated on the after end of this deck is the paying-out machinery with its attendant dynamometer, jockey gear, stern sheaves, and handling gear. Under the boat deck abreast the cable hatches is the accommodation for the cable staff, electricians, officers, and other leading members of the crew; also a large dining saloon, smoke room, testing room, radio room, &c.

The upper deck in the forward watertight compartment contains a steam windlass and engines for the capstans on the deck above, and further aft is situated the main cable machinery, which is of Messrs. Siemens Bros. & Co.'s design, and was constructed by Palmers Shipbuilding and Iron Co., Ltd., which built the ship. Abreast of this machinery are the store, paint, and lamp rooms. The stern compartment of this deck is fitted up for the steam steering gear of the Wilson-Pirrie type, controlled from the navigating bridge by telemotor. A Siemens electric helm indicator is fitted, by means of which the angle of the ship's rudder is shown in a positive and reliable manner on the navigating bridge. Various store rooms and workshops for blacksmiths, jointers, electricians, and carpenters are provided, and also cold chambers of sufficient capacity to store provisions for long periods at sea, whilst there are as well a CO_2 refrigerating machine and an engineers' workshop.

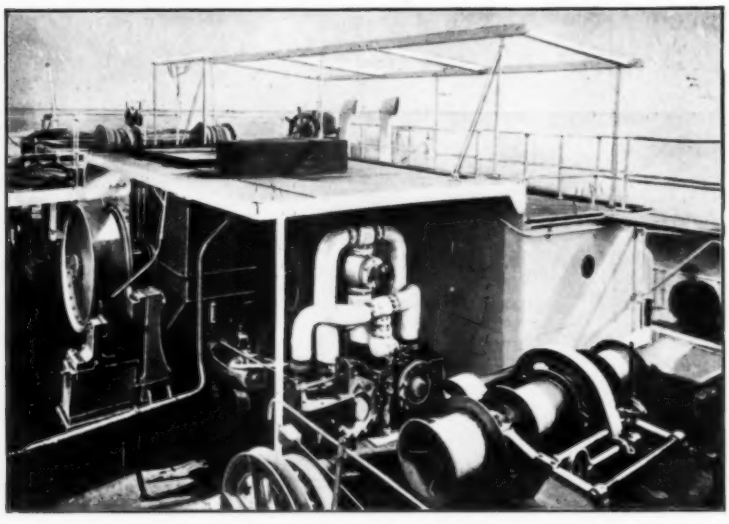

Fig. 5.—After End; Paying-out Machine.

The two engines are of the triple-expansion type, arranged to work on three cranks placed at equal angles and driving twin screws. The engines will develop 2,960 i.h.p. at sea when running at about 88 r.p.m. The cylinders are respectively 21 in., 34 in., and 57 in. in diameter, and the stroke is 39 in. The main condensers are cylindrical and constructed of steel plates. The circulation is maintained by separate centrifugal pumps, and the usual separate pumps are provided for the feed, ballast, bilge, and sanitary services, and the heater and filter for feed water.

Steam is supplied at a pressure of 180 lb. per sq. in. by three single-ended boilers, 15 ft. 3 in. dia. x 11 ft. 3 in. long, each having three furnaces fitted with Howden forced draught, the furnace fronts being arranged for burning oil exclusively.

The engines are arranged so as to be capable of working at a very low speed, in order to drive the vessel, when necessary, at about three-quarters of a knot. A Siemens patent ahead and astern revolution indicator is provided for each engine. This apparatus indicates to the officer on the bridge that the orders to the engine room have been carried out, and shows the first and every revolution, as well as the direction of rotation, of each engine.

Fig. 6.—Dining Saloon.

Loud-speaking marine telephones of the company's make are installed on the bridge and various other points on the ship. A Siemens "look-out" indicator is also fitted, which enables the "look-out" man to signal to the bridge the position of any object he observes. Electrical indicators are provided for the navigation lights, to show whether they are functioning correctly in every respect, and the radio-telegraph station is fitted with a Siemens quenched-spark, 1½-kW set with extra long-range valve reception apparatus. The vessel is, of course, electrically lighted, with oil lamps as a stand-by, and electric fans are installed in all the cabins and various other apartments.

It will be recalled that the new c.s. *Faraday* was launched on February 16th this year at the Jarrow shipyard of Palmer's Shipbuilding & Iron Co., Ltd. Her steel hull was constructed under special survey to class

Fig. 7.—The Navigating Bridge.

100 A1 of Lloyd's Register of Shipping, shelter deck type with freeboard. Her leading particulars are as follows:—Length over bow and stern sheaves, 415 ft.; length between perpendiculars, 380 ft.; breadth extreme, 48 ft. 3 in.; depth moulded, 29 ft. 3 in.; draught

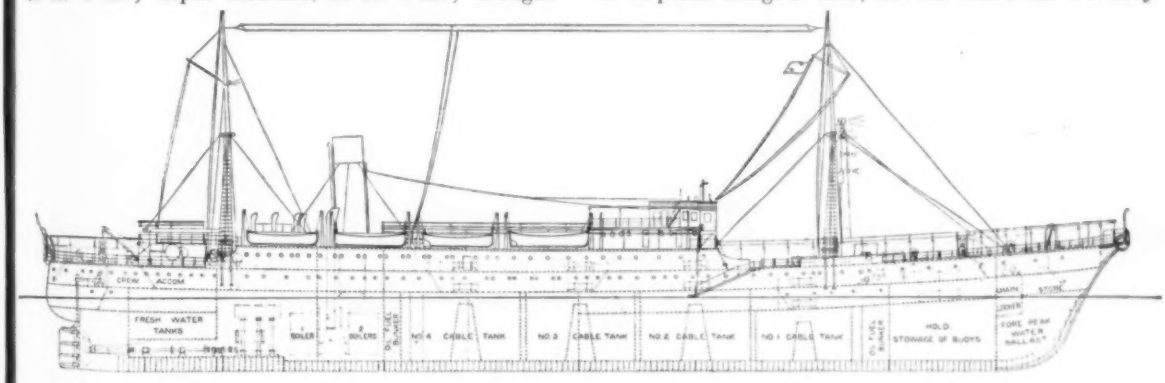

Fig. 8.—The New Cable Ship "Faraday."

designed, 27 ft. 3 in.; gross tonnage, 5,370; net tonnage, 2,640; water ballast capacity, 2,200 tons; fuel oil capacity, 1,500 tons; and speed, 12 knots.

The general arrangement of the ship is shown in the accompanying drawing, fig. 8, from which it will be seen that she has a double bottom adapted for carrying either water ballast or oil fuel. Oil fuel is also carried in the cross bunker fore and aft of the cable tanks and separated from them by spaces which can be used for additional water ballast to ensure ample immersion of the vessel when her cable is discharged.

We trust the good ship *Faraday* will have a long, profitable, and interesting life. Cable-laying steamers perform national and international service of the best sort—they touch the lives of nations in a most intimate way, and contribute largely to the improvement of the material well-being of the world's population. It might be safely prophesied that the new *Faraday* will in a not less important way than the old vessel of the same name serve millions of people yet unborn through her work of cable laying, which by linking up continent with continent makes it possible to keep in touch with events in all parts of the globe and permits of that rapid interchange of views which frequently does so much to dispel misunderstandings—for she will be a unit in that vast and complex commercial system which has grown up and by which we live.

Judging by the appointments and our entertainment at Captain Gange's table, life on board the *Faraday* should be very far from disagreeable. The fact that an English firm is manufacturing and laying this important cable needs no comment. Messrs. Siemens are exceeding busy; in fact, new cable-making plant is about to be installed in their extensive works.

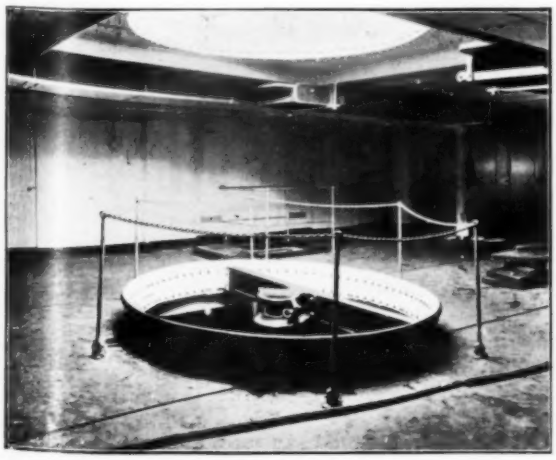

Fig. 9.—Main Deck; Hatchway and Cable Tank.

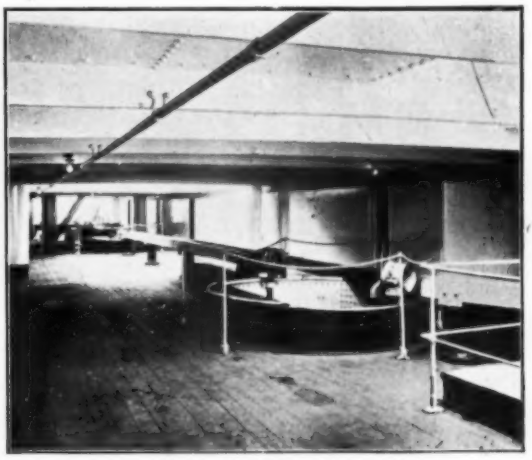

Fig. 10.—Shelter Deck; Hatchway, Cable Tank and Troughing.

THE CARLISLE ELECTRICITY UNDERTAKING.

Inauguration of New Plant.

On July 10th, the Mayor, Mr. Robert Dalton, accompanied by members and officials of the City Council and a number of visitors, visited the municipal electricity generating station and started a new turbo-generator that has recently been installed. The machine, which is rated at 3,000 kW at a speed of 3,000 r.p.m., is accommodated in the existing building on the floor space previously occupied by reciprocating sets which represented the original installation of 375 kW.

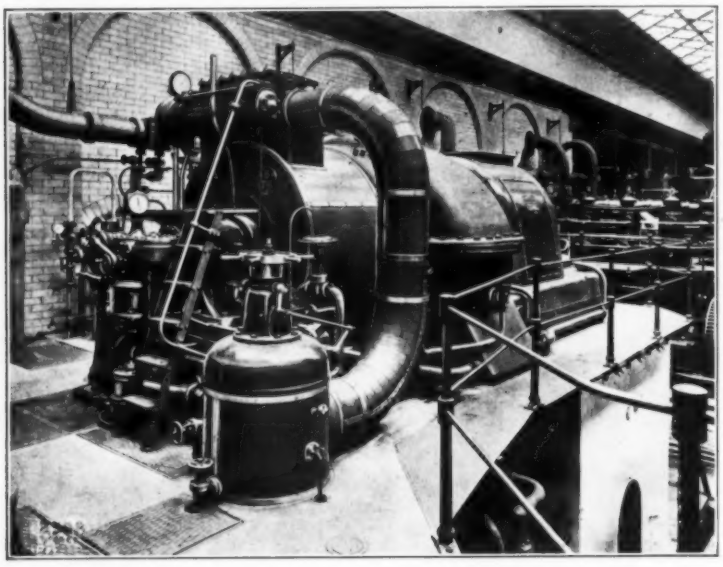

Fig. 1.—A 3,000-kW B.T.H. Turbo-Alternator at Carlisle.

The extension has been designed to the specification of Mr. C. W. Salt, M.I.E.E., city electrical engineer, to be suitable for the transference of the plant to the new station which is to be built. The aggregate sum which the work was estimated to involve was £40,000, but although the capital account has not yet been closed, it is understood that the actual expenditure will be considerably less than that estimated.

The new set, which is illustrated in fig. 1, was manufactured by the British Thomson-Houston Co., Ltd., which also supplied the voltage regulator, auxiliary switchgear, and motors, the alternator cooling air filter being furnished by Messrs. W. Grice & Sons. Messrs. Hick, Hargreaves & Co., Ltd., supplied the main condenser, fig. 2, air extractor and condensate pump. The circulating water pump is capable of delivering 270,000 gallons per hour; it was made by Messrs. Worthington-Simpson, Ltd., and is driven by a 60-h.p. motor manufactured by the Lancashire Dynamo & Motor Co., Ltd.

Messrs. F. W. Brackett & Co., Ltd., furnished the condenser water screening plant, and the Metropolitan-Vickers Electrical Co., Ltd., the main switchgear and meters. The Cambridge & Paul Instrument Co., Ltd., supplied electric thermometer and pyrometer equipment; Messrs. W. Sanders & Co. ironclad fusegear for the auxiliaries; and Messrs. Royles, Ltd., a feed-water heater; new boiler plant is also to be installed on the present site.

The progress made by the undertaking is revealed by the fact that during the war period the output was increased from 3½ to 5½ million kWh per annum; in the four years since the end of the war the output exceeded 7 million kWh per annum, and new consumers are being connected at the rate of 300 per year, while new mains are being laid at the rate of about 7 miles per year.

After inspecting the station, the company was entertained at luncheon by the Mayor, who is also chairman of the Electricity Committee. Mr. J. P. Gregory (B.T.H. Co.), in the course of a speech, congratulated the Corporation on having within its territory (on the river Eden) such an admirable site for the contemplated new station, where he estimated there was sufficient cooling water available for probably a 100,000-kW station.

The Mayor emphasised the impossibility of any further extensions being made at the existing works, and remarked that Sir John Snell, Chief Electricity Commissioner, had (unofficially) supported Mr. Gregory's views about the new site. He was pleased to think that during recent years there had been amity of relationship between the chairmen, members, and officials of the Gas and Electricity Committees, and that they worked in perfect harmony; there was room for both undertakings. When they had read the report that Mr. Salt had prepared with regard to electricity, which would come before them next September, they would agree to spend more than the £200,000 estimated by Mr. Salt to be needed for new work at Carlisle.

Mr. A. Creighton, Deputy Mayor, said he remembered the heartburnings which took place when they ordered their first large turbine from the Oerlikon Co. British firms were beaten on every point, but the tables were now turned, and for the present tender British firms were first all along the line.

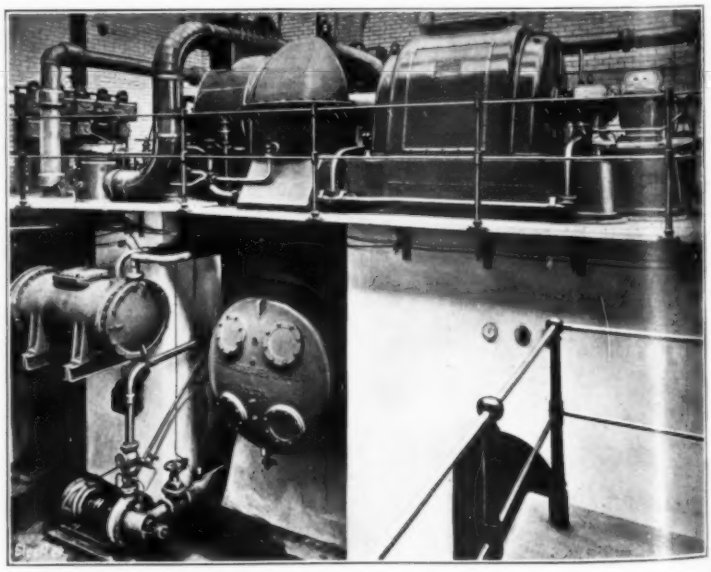

Fig. 2.—Hick, Hargreaves Condensing Plant.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared in our advertisement pages.)*

OPEN.

Australia.—Melbourne.—October 24th. Victorian Government Railways. Two one-ton electric hoists with trolley wires and current collectors.—*Reuter's Trade Service* (Melbourne).

Victorian Electricity Commission. October 6th. Specification No. 23/117, 22,000-V insulators in connection with the Morwell power scheme. (July 20th.)

Commonwealth Government.—Various dates. Cable distributing terminals; bells, cords, and plugs; switchboards; telephone parts; motor-generator sets; and submarine cables. (See this issue.)

South Australia.—September 18th. Harbours Board. Four 7-ton electric travelling coal-unloading cranes.—*Reuter's Trade Service* (Melbourne).

Sydney.—September 19th. New South Wales Government Railways and Tramways. One 7,500-kW frequency changer for White Bay power house. Chief electrical engineer, 61, Hunter Street, Sydney.*

August 30th. Postmaster-General's Department. Motor generators.*

Bowen (Queensland).—September 3rd. Municipal Council. Plant and works in connection with the electricity supply undertaking: Boiler plant, steam-driven electricity generating plant, main switchboard. Messrs. A. E. Harding Frew and T. W. Bridger, consulting engineers, Telegraph Chambers, Queen Street, Brisbane.

Belgium.—August 6th. Municipal authorities of Ulbeek (Province of Limbourg). Establishment of a l.p. electricity distribution system to serve the communes of Ulbeek, Alken, and Wellen-Herten.

August 11th. Municipal authorities of Waterloo (Province of Brabant). Establishment of an electricity distribution system in the town.

Belfast.—August 13th. Electricity Department. Transformer oil. (See this issue.)

Bradford.—August 16th. Corporation. Supply and erection of two 1,000-kW rotary or motor converters. (July 27th.)

Doncaster.—August 6th. Electricity Department. One 250-kW rotary converter and h.p. switchgear. (July 20th.)

Eccles.—August 4th. Electricity Department. Two 200-kW sets for converting 6,600-V, 3-phase a.c. to d.c. at 550 V. (July 20th.)

Edinburgh.—September 3rd. Electricity Department. Supply and erection of a 33,000-V overhead main transmission line. (July 27th.)

Fife.—Kirkcaldy.—Fife Education Committee. Electric lighting installation at new school, Blairhall, near Culross. Mr. Gentles, surveyor, 184, High Street, Kirkcaldy.

France.—Paris.—August 9th. French Ministry of the Colonies, 27, Rue Oudinot, Paris. Copper wire required for the Post, Telegraph, and Telephone authorities in Indo-China. The municipal authorities of Champlitte (Haute Saône) are inviting offers for the concession for the electric lighting of the town. The present concession expires in April next.

Grimsby.—September 4th. Electricity Department. One 1,000-kW turbo-alternator, with condenser, pipework, motor-driven auxiliaries, &c. (July 27th.)

Hazel Grove and Bramhall.—August 20th. Urban District Council. Three-phase, four-core, lead-covered and armoured cable; l.p. sub-station switchgear; and a.c. electricity meters. (July 27th.)

Hong-Kong.—The Government of Hong-Kong invites tenders for a concession to run an electric tramway service on certain roads in the Kowloon Peninsula. (See this issue.)

Irish Free State.—Ennis (Co. Clare).—August 14th. Committee, Clare Mental Hospital. Electric lighting plant: Two 200-V dynamos, direct coupled to 50-h.p. suction gas engines; two dynamo shunt regulators; one electric motor fan for gas plant; one d.c. switchboard, including all switchgear (metal cubicles and screens); one motor generator, including starter and shunt regulator; storage battery, 118 cells, 640-Ah capacity; wiring of buildings, and overhead wiring to power house. Specifications from the Clerk to the Clare Mental Hospital Committee, Ennis, Co. Clare, Ireland.

Kilmarnock.—Corporation. Electric lighting installations in 30 houses in course of erection. Mr. T. C. Stewart, surveyor, 61, Portland Street, Kilmarnock.

Leeds.—September 3rd. Electricity Department. Supply and erection of 3-phase switchgear. (July 20th.)

London. — London County Council. — September 17th. Machine tools for the Council's tramway central repair depôt. Manager, L.C.C. Tramways, Victoria Embankment, W.C.

H.M. Office of Works. August 21st. Electrical wiring installation at Somerset House, Strand, W.C. (See this issue.)

St. Pancras.—August 15th. Electricity Committee. One 5,000-kW steam turbine with 3-phase alternator and condensing plant, &c. (See this issue.)

Macao.—September 15th. The Macao Government invites tenders for the construction and exploitation of a wireless station, electric power machinery, and electric conveyances.—*Reuter's Trade Service* (Shanghai).

New Zealand.—August 21st. Public Works Department. Supply of a steel runway for a crane at Khandallah sub-station, section 84, Mangahao. Deposit £25, bond £35. Sealed tenders to the Secretary, Public Works Tenders Board, Wellington.*

Auckland.—August 9th. Municipal Tramway Department. Two miles 7/12 galvanised steel span wire; 1 mile No. 12 h.d. copper wire; 2 miles 37/.083 triple-braided aerial cable; 500 yd. 37/.083 lead-sheathed cable, joint boxes, &c.; and 12,000 ft. of glazed earthenware troughing. Particulars and specifications from Downie Bros., 7, Fenchurch Avenue, E.C.3.

South Africa.—Johannesburg.—August 8th. Municipal Council. Field coils for traction motors.*

Spain.—Cartagena Harbour Authority. Tenders are invited for the supply of four electric cranes, four electrically-operated capstans, and the necessary plant for converting three-phase current to d.c.

Warrington.—August 11th. Supply of three electrically-driven centrifugal pumps for Waterworks Department. Deposit £1 1s. (returnable). Particulars from Mr. J. Gray, waterworks engineer, Municipal Offices, Warrington.

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

CLOSED.

Amble.—Urban Council. Accepted:—
Erection of plant and overhead mains in connection with the electric lighting scheme.—Graham Bros., Middlesbrough.

Birkenhead.—Town Council. Accepted:—
Supply and laying of h.p. main cables in the borough (£10,075).—W. T. Henley's Telegraph Works Co., Ltd.

Blackpool.—Education Committee.
Electrical installation in the Devonshire Road Board School.—Mr. Geo. Morrison.

Blean (Kent).—Board of Guardians.
Electric lighting installation at the Institution (£325).—S. Terry.

Colchester.—Board of Guardians. Accepted:—
Installing electric lighting in the Master's quarters and casual ward.—Truslove & Co.

Dewsbury.—Board of Guardians. Accepted:—
Electrical fittings for a new block at Staincliffe Institution.—J. F. Rispin.

Edinburgh.—Town Council. Accepted:—
Eight top-covered car bodies (£5,680).—Bristol Waggon and Carriage Works Co., Ltd.

Epsom.—Urban Council. Accepted:—
Engine and dynamo (£3,841); maintenance for eight years (£1,050).—Vickers-Petter, Ltd.

France.—La Société des Constructions Electriques de France (C.E.F.), which is specialising in the construction of electric locomotives, has secured contracts for no less than 127 of the 377 engines ordered for French railways, the remaining 250 being divided between ten other concerns.

Glasgow.—Tramway Committee. Recommended:—
Trolley wire.—British Insulated & Helsby Cables, Ltd.
Copper strip.—Leslie & Hall, Ltd.; and C. Henderson & Co., Ltd.
Cables.—Western Electric Co., Ltd.; and Siemens Bros. & Co., Ltd.
Bitumen.—J. Greenshields & Co., Ltd.; Jack, Son & Co., Ltd.; McCreath, Taylor & Co., Ltd.; Craig Sharp, Ltd.; and George Walker, Sons and Co.

Housing Committee. Recommended:—
Electric lighting installation in connection with the Cathcart Road housing scheme (£583).—Munro & Co.

Halifax.—Tramways and Electricity Committee.
Alteration of premises in Town Hall Street East, for electricity showrooms (£1,334).—J. Lees & Sons.
2-2½-ton chassis and two 25-h.p. motors in connection with trackless trolley vehicle service (£763).—Tilling-Stevens Motors, Ltd.

India.—Bombay, Baroda, and Central India Railway.
14,052 Siemens vacuum and gasfilled-type train-lighting lamps.—Siemens and English Electric Lamp Co., Ltd.

London.—Southern Railway Co.
Four months' supply of incandescent electric lamps.—Siemens and English Electric Lamp Co., Ltd.

Metropolitan Asylums Board.—Installing electric lighting in kitchen block, &c., at Southern Hospital:—

G. H. Neal & Co., Ltd. (Recommended.)	**£151**
Harrison Bros. (Electrical Engineers), Ltd.)	167
Perfecto Electrical Co.	174
G. H. Turner & Co., Ltd.	180
Symper & Evershed	186
D. Henderson	242
Strange & Sons, Ltd.	259
Higgs & Hill, Ltd.	267
H. A. Neale & Co.	283
Farndons Electric, Ltd.	296
Electric Power Installation Co.	298
Riddle & Goddard, Ltd.	313
A. Higginbotham & Sons	315
Johnson & Turner, Ltd.	320
Edmundson's Electricity Corporation, Ltd.	350
A. Cozens	400
Guild of Engineers (London), Ltd.	444
A. Ansell	478
Thornton, Fleming & Fletcher	550

St. Pancras.—Electricity and Public Lighting Committee. E.h.p. switchgear for King's Road power station:—

	£	Breaking capacity, kVA.
Ferguson, Pailin, Ltd.	20,203	450,000
English Electric Co.	15,155	400,000
Metropolitan-Vickers	15,543	300,000
General Electric Co.	17,403	350,000
Park Royal Engineering Works	19,398	350,000
***Reyrolle & Co.** (Recommended.)	**19,980**	**150,000**
New Switchgear Co.	21,186	350,000
Bertram Thomas	22,014	—
Switchgear & Cowans	22,477	450,000
Whipp & Bourne	31,640	350,000
British Thomson-Houston	38,822	—
Johnson & Phillips	40,376	—

* Including automatic regulators.

The chief electrical engineer, in his report on the tenders, states that the future total capacity of the power station at King's Road figures largely in the choice of switchgear, and, having in mind the possibilities of development there, it would appear that the larger unit of switchgear would be most economical to install in the long run. In this case the breaking capacity would be from 400,000 to 450,000 kVA, and the choice of plant is brought down to the offers of Messrs. Ferguson, Pailin, Ltd., and Messrs. Reyrolle & Co., Ltd.

The time for completion by Messrs. Ferguson, Pailin, Ltd., is five months, and by Messrs. Reyrolle & Co. four months.

The Electricity Committee recommends that the tender of Messrs. A. Reyrolle & Co., Ltd., at £19,980, be accepted.

Four panels for the l.p. switchboard at Tavistock Place sub-station:—

Park Royal Engineering Works, Ltd. (Recommended.) ...	**£470**
Northcote, Heaver & Co.	490
Bertram Thomas	508
Whipp & Bourne	511
E. Moy	549
General Electric Co., Ltd.	560
Johnson & Phillips, Ltd.	568
British Thomson-Houston, Ltd.	580
White & Co.	620
Ferguson, Pailin, Ltd.	644

36-in. cast-iron condensing-water main at the King's Road power station:—

G. Bell & Sons, Ltd. (Recommended.)	**£2,580**
J. Mowlem & Co.	2,733
Chessums, Ltd.	2,911
J. Gill, Ltd.	3,500
D. G. Somerville & Co., Ltd.	4,247

L.p. switchgear at King's Road power station. Twenty-two completed tenders were received:—

J. G. Statter & Co.	£2,578
Bertram Thomas, Ltd.	2,725
Reyrolle & Co., Ltd.	2,725
Switchgear & Cowans, Ltd.	2,725
Electric Construction Co.	2,989
Edison Swan Electric Co., Ltd.	3,020
Whipp & Bourne	3,030
Park Royal Engineering Works, Ltd.	3,175
Harland Engineering Co., Ltd.	3,275
Northcote, Heaver & Co.	3,363
Clarke, Chapman & Co., Ltd.	3,465
Cecil Hodges	3,490
Westwood Manufacturing Co.	3,500
Ferguson, Pailin, Ltd.	3,608
British Thomson-Houston Co., Ltd.	3,726
Cox Walkers	3,800
Metropolitan-Vickers Electrical Co., Ltd.	3,906
New Switchgear Co., Ltd.	4,330
General Electric Co., Ltd.	4,348
Johnson & Phillips, Ltd.	4,550
Nalder Bros. & Thompson, Ltd.	5,065
Erskine, Heap & Co.	5,080

London County Council.—Highways Committee. Fitting 200 tramcars with high-powered motor equipments:

†General Electric Co., Ltd.	£139,000
English Electric Co., Ltd.	164,000
Ditto (alternative)	165,200
Metropolitan-Vickers Electrical Co., Ltd.	164,000
Ditto (alternative)	165,200
British Thomson-Houston Co., Ltd.	202,000
Ditto (alternative)	203,200

†Not to specification.

The estimate of the general manager, Tramways Department, comparable with the tenders, amounts to £142,000.

After careful consideration, the Committee proposes to divide the contract equally between the English Electric Co., Ltd., and the Metropolitan-Vickers Electrical Co., Ltd., whose tenders are the lowest received strictly in accordance with the specification. By dividing the contract in this manner, it will be possible to reduce by 50 per cent. the time required for the delivery and fitting of the new equipment.

Stepney.—Electric Supply Committee.

50 single 2-way disconnecting boxes (£64).—W. Lucy & Co., Ltd. (Recommended.)

Conduits and troughs and covers for 12 months:—

Sutton & Co. (Overseal), Ltd. (Recommended.)	**£3,168**
W. T. Henley's Telegraph Works Co., Ltd.	3,241
Siemens Bros. & Co., Ltd.	3,404
Albion Clay Co., Ltd.	3,604

St. Marylebone.—Electric Supply Committee.

Closed-circuit air coolers for the two 8,000-kW turbo-alternator sets (£2,520).—Heenan & Froude, Ltd. (Recommended.)

Variation of the gantry in connection with the supply and erection of a 60-ton per hour crane and gantry at the generating station (£415).—Babcock & Wilcox, Ltd. (Recommended.)

Special cables for the 12,500-kW turbo-alternator and rotary converter plant at the generating station and sub-stations:—

	E.h.p. Cables. £	L.p. Cables. £
W. T. Henley's Telegraph Works Co., Ltd.	530	1,620
British Insulated & Helsby Cables, Ltd.	512	1,504
Enfield Ediswan Cable Works, Ltd. (Recommended.)	476	1,451

Salford.—Electricity Committee. Accepted:—

Six 6,000-kVA single-phase transformers and one 6,000-kVA spare transformer (£23,385).—Metropolitan-Vickers Electrical Co., Ltd.

Three-core, 33,000-V cables and auxiliary cables, &c. (£24,380, approx.).—British Insulated & Helsby Cables, Ltd.

2,215 yd. e.h.p. 3-core paper-insulated lead-covered cable (£1,341); 973 yd. l.p. 4-core ditto (£624); 5,250 yd. l.p. ditto (£1,164).—W. T. Glover and Co., Ltd.

Pressure-testing transformer (£172).—Ferranti, Ltd.

Stoke-on-Trent.—Electricity Department. Accepted:—

One 5,000-kW turbo-alternator and condensing plant (£27,482).—Metropolitan-Vickers Electrical Co., Ltd.

Sunderland.—Sunderland and South Shields Water Co.

Electrical pumping plant and motors in connection with waterworks extensions at Downhill.—Sulzer Bros.

THE "ELECTRICAL REVIEW" SERVICE DEPARTMENT.

We have to remind readers that Service Department inquiries should be accompanied by a stamped addressed envelope.

The makers or suppliers of the following devices are asked for:—

Cut Crystal Electric Table Lamps, Pattern No. 258.

NOTES.

Mid-Lancashire Electricity District. — The Electricity Commissioners held an inquiry at Preston on July 31st, regarding the agreed scheme for the Mid-Lancashire Electricity District, to which various municipal authorities were consenting parties in March last. The project provides for the establishment of a Mid-Lancashire Electricity Committee, and the Commissioners have prepared a draft order giving effect to the decision, which came under review at Tuesday's sitting. Sir John Snell presided, and he was accompanied by Mr. H. Booth and Mr. D. S. Cumberlege sitting as clerk; there was a representative attendance.

The chairman reported that no representations indicating opposition had been made since the last inquiry was held. An application for the representation of the Electric Power Co. to be increased from one to two was opposed, the company's counsel stating that it was proposed to erect a power station at Padiham, the increased representation to take effect from that date. The Commissioners decided to give the matter consideration, and the chairman agreed to recommend the Commissioners to withdraw certain provisionally-approved amendments from the technical scheme. Sir John mentioned that the Lancashire Power Co. had applied for permission to erect the station at Padiham.

Educational.—University College, London.—A Goldsmid scholarship, tenable in the Faculty of Engineering at University College, London, of the value of £90 (£30 a year for three years, subject to satisfactory progress) will be offered for competition at an examination to be held at the college in September. Particulars may be obtained on application to the secretary of the college.

Appointments Vacant.—A well-known switchgear manufacturer is advertising for an electrical engineer as draughtsman-designer (£600-£1,000); electrical engineer (£350), by the Ilkley Urban District Council; master, to act as head of the electrical engineering department of the Rugby Technical School (Burnham Scale Rate +/ £50); lecturer in electrical engineering, for the Acton and Chiswick Polytechnic. See advertisement pages.)

Ministry of Transport and Electricity Supply.—The report by the Minister of Transport respecting the applications to, and proceedings of the Ministry of Transport under the Electricity (Supply) Acts, 1882 to 1922, for the year 1922 has been published, and copies can be obtained, price 9d., at H.M. Stationery Office. A *résumé* of the report is as follows:—During the past year two Orders were made, namely: The (a) South-West Midlands Electricity District Order, 1922; and (b) the South-East Lancashire Electricity District Order, 1923, both of which were confirmed by the Minister and subsequently approved by resolutions of Parliament. These are the first two Orders under Section 7 of the Electricity (Supply) Act, 1919. The position as regards the remaining districts is set out in the appendix to the report. During the year the Minister confirmed 34 Special Orders, giving powers of various sorts, and two further Orders were confirmed for the supply of electricity in bulk; also the Minister made 35 Orders revising charging powers. Consent to the erection of overhead lines during the year was given in 91 cases. Six applications were received for consent to wayleaves; after holding a local inquiry in each case the Minister gave his consent in four cases and refused it in one; the sixth application was withdrawn. Paragraphs 25 and onward of the report deal in outline with the proceedings of the Electricity Commissioners during the period under review. The Commissioners will in due course issue a fuller report of their own proceedings.

Battery-charging Signs.—The Electric Vehicle Committee of the Society of Motor Manufacturers and Traders has distributed 400 transparent signs to battery-charging stations throughout the country for fixing in prominent positions to indicate facilities for re-charging electric motor vehicles.

A Radio Exhibition in Ulster.—A well-organised wireless exhibition was opened at Ye Olde Castle Restaurant, Belfast, on June 20th by the Lord Mayor (Alderman W. G. Turner, J.P.). The exhibition was conducted under the auspices of the Northern Radio Association which, under the presidency of Captain J. N. Inglis, forms the centre of radio-telephone interest in Northern Ireland. The Lord Mayor, in opening the exhibition, explained that its object was twofold—to enable members of the Northern Radio Association to inspect the various types of apparatus on the market and to arouse the interest of friends and visitors who as yet were not radio enthusiasts. Most of the leading manufacturers, including the General Electric Co., Ltd., were represented on one or more stands, and excellent displays of sets, both crystal and valve models, component parts, accessories, and loud-speaker equipment were exhibited. A unique feature of the exhibition was that no demonstrations or active selling propaganda were allowed, so that visitors were enabled to inspect goods at their leisure without the dread of encountering the specialised salesman. A very fine six-valve receiving set shown was made up entirely of "Gecophone" standard components and accessories.

A Large Coal Hoist.—What is claimed to be the largest coal mining hoist in the world will be installed at the Orient No. 2 mine of the Chicago, Wilmington and Franklin Coal Co., at West Frankfort, Ill., by the Westinghouse Electric and Manufacturing Co. and the Nordberg Manufacturing Co. The Westinghouse Co. will furnish the complete electrical equipment for the hoist. The largest coal hoist in North America at present is equipped with a motor having a capacity of 1,400 h.p., whereas the capacity of the motors of the Orient No. 2 hoist will be 4,400 h.p., divided between two motors, one mounted at each end of the drum shaft and each having a capacity of 2,200 h.p. at 40 deg. C. temperature rise. Coal will be hoisted in skips at the Orient mine, each skip having a normal capacity of 22,000 lb. and a maximum capacity of 25,000 lb. The depth of the shaft is 607 ft., and the coal will be dumped from the mine cars at the bottom of the shaft by means of rotary dumps. Under normal conditions the output per hour will be 1,500 tons and under the maximum conditions it can be increased to 2,000 tons per hour.

The maximum hoisting speed to be obtained will be over 4,000 ft. per minute. Operation will be at an exceptionally high speed, the entire operation of a single cycle from the time the skip starts from the bottom until it reaches the dumping position at the top requiring only 16 seconds. This high speed of operation will involve very heavy peak loads during acceleration and heavy regenerative loads during retardation. The actual load during acceleration will be about 8,000 h.p. and the regenerative load during retardation about 4,000 h.p. Power will be supplied to the hoist motors through a flywheel motor-generator set, equipped with two 1,800-kW, 600-volt, 600 r.p.m., commutating pole, compensated d.c. generators driven by a 2,200-h.p., 2,200-volt, three-phase, 60-cycle, 600-r.p.m., wound-rotor induction motor. The motor generator set is to be equipped with a 90,000-lb. flywheel 12 ft. in diameter and built up of steel plates. The control for the hoist will be provided with safety devices, and automatic acceleration and retardation are included. Although the maximum variation in horse-power during a cycle at the hoist motor is from 8,000 positive to 4,000 negative, the power drawn from the mains by the a.c. induction motor will remain practically constant at about 2,000 h.p.

Nitrogen from Air.—Speaking at the annual meeting of the British Cyanides Co., on July 18th, Mr. Kenneth M. Chance (managing director) told the shareholders that the company was now in a position to obtain nitrogen from the atmosphere in unlimited quantities for the cyanogen products which the company manufactured. Estimates were being prepared for new plant to be erected at once.

A process for the manufacture of permanganate of potash by electrolysis had also been perfected at the company's works. The necessary plant was now in course of erection, and should be working in the near future.—*Financial Times.*

The Metric System.—At a meeting of the Board of Directors of the Manchester Chamber of Commerce on July 16th, resolutions were passed urging traders to use the litre and kilogram in preference to the gallon and ton, which are capable of varying interpretations.

A resolution on somewhat similar lines was passed at a recent meeting of the Association of British Chambers of Commerce. This resolution mentioned the difference existing between the American and Imperial gallons, and urged that "all trades, especially those engaged in Overseas trade, should employ some universally accepted measure, such as the litre, the use of which is already permitted by law, as the sole unit of capacity."

Electricity Supply in London.—On July 31st, the London County Council considered the report of the Special Committee on London Electricity, which had made certain recommendations regarding the reorganisation of electricity supply. The Committee proposed that a joint electricity authority be established for the Greater London area, providing a satisfactory scale of prices and dividends can be agreed; the London companies be empowered to amalgamate; companies to have financial and administrative independence, subject only to the control of the authority with regard to technical development, disposal of surplus energy, and certain capital expenditure. It was also recommended that, in view of the large measure of autonomy to be given the London companies, their representation on the Authority should be very small. The Committee's proposals were approved.—*The Times.*

Large New South Wales Electrical Scheme.—An ambitious electrical scheme, to cost £1,000,000, is to be commenced next September by the New South Wales Railway Commissioners. The scheme provides for the erection of a hydro-electric power station at Marrangaroo, which it is hoped to have completed within ten years. All the plant will have to be specially made in Great Britain. The station will provide electricity for railway purposes and, in addition, towns on the mountains from Penrith to Lithgow and west as far as Dubbo will be supplied at 1d. per kWh.—*Reuter's Trade Service* (Melbourne).

United States Electric Vehicle Market.—The truck division of the electric vehicle market continues active and manufacturers are optimistic with regard to the future. The following were among the contracts placed in the Metropolitan district during the four weeks ending July 20th: a department store, eight trucks; a bakery company, ten trucks; utility companies, five trucks; a large candy manufacturer purchased one truck as an experiment and will buy two more in the autumn. Evidence of the improvement in the electric truck industry is seen in a comparison of sales for June, 1922, and June, 1923; in June, last year, nine trucks, of a total tonnage of 22, were sold; sales of trucks in June this year totalled 43, with a tonnage of 117½.

The Society for Electrical Development, Inc., has issued the first of a series of monographs, a copy of which will be sent to the executives of every power company in the country. The brochure shows what the electric truck-charging business means to the industry and what is being overlooked by not investigating the possibilities of the electric truck as an important factor in increasing the profits of the power companies. The Society has recently started a Press service and the brief stories covering activities in the electric truck field are being widely used by newspapers in all parts of the country. Sixteen electric trucks and passenger cars, valued at $25,044, were exported during May, against 26, valued at $27,235, in the corresponding month of last year.—*Reuter's Trade Service* (New York).

Electricity in Pneumonia Treatment.—Remarkable success in the treatment of pneumonia by the use of electricity was reported recently by physicians on the staff of St. Mary's Hospital, Hoboken, U.S.A., where the new method perfected by Dr. Harry E. Stewart was tested. The method consists of the application of plates to the chest and back of the patient and passing high-frequency alternating current through the lungs. This increases the temperature within the lungs, it is claimed, tending to break up congestion. More than 30 sufferers in the last stages of pneumonia are said to have been started on the road to recovery in this way. The new treatment, which has been called a "super-mustard plaster," is intended not as a substitute for the usual medical treatment of the disease, but to supplement other agencies, and is repeated twice each day.—*Popular Science Monthly.*

Cast-Iron Piping.—Electrical engineers have only an indirect interest in steam piping, but in a generating station many cast-iron pipes are used; engineers-in-charge should therefore profit by the report of the inquiry into an explosion that occurred at the Burnley Union Workhouse, which resulted in the death of a stoker. The pipe was 6 ft. 2¼ in. long, and of 6 in. bore. It was porous, varied in thickness from ¾ in. to 1 in., and had a tensile strength of 7.32 tons. The surveyors practically condemn cast-iron piping as not being flexible, resilient, or capable of withstanding severe strains due to temperature variations and water hammer; yet, for moderate steam pressures, and even when the steam is not superheated, cast-iron has advantages over wrought-iron and steel. Cast-iron pipes are cheaper and more quickly obtained in odd lengths; when made in a specialist pipe foundry to standard lengths there is practically no thickness variation, the metal is uniformly good, and has a comparatively high tensile strength. Best quality steam pipes cannot be obtained from small jobbing foundries at the shortest notice. In some foundries pipe work, whether steam or water pipes, is not considered important, and any mixture is considered good enough. The remedy is for customers to demand that the castings shall be up to a certain specification and test them carefully before erection to see that they are so.

Scientific Copyright.—*The Times* correspondent at Geneva reports that the Intellectual Co-operation Commission of the League of Nations decided on July 28th to submit to the Council and to the Assembly of the League a draft Convention for the Protection of Scientific Discoveries, drafted by Professor Ruffini. In submitting this draft Convention the Commission is asking the Governments to establish for scientific discoveries a copyright similar to that granted for literary and artistic work.

Clothworkers' Gift to Engineering Science. — The *Daily Telegraph* states that the Clothworkers' Company of the City of London has offered an annual contribution of £3,000 for the period of five years 1923-1927 to the governing body of the Imperial College of Science and Technology, South Kensington, to be applied towards the maintenance and development of the City and Guilds (Engineering) College one of the three constituents of the Imperial College of Science. This donation is supplemental to the sum voted some years ago by the Goldsmiths' Company, a gift amounting to £85,000, which enabled the Engineering College to extend its premises, and is quite distinct from the annual vote of £5,000 from the City and Guilds of London Institute which has been paid to the Imperial College since the Charter was granted some fifteen years ago and applied to the City and Guilds (Engineering) College.

South African Railway Electrification.—The *S.A. Mining and Engineering Journal* states that work is proceeding with the Colenso power station which is to supply electricity for the working of the Glencoe-Maritzburg section of the electrified South African railways. The building is situated upon the Tugela River, and the site is connected up to the main railway by a branch line. The boiler house is 148 ft. long, and there is room for extension. It contains eight water-tube Babcock & Wilcox boilers (with superheaters and air-heaters) capable of producing 60,000 lb. of steam per hour at a pressure of 270 lb. per sq. in., superheated to 700 deg. F. A steel-plate overhead bunker, capable of holding 500 tons of coal, is arranged above each row of boilers. Stokers are of the travelling grate type. The mechanical draught system consists of Sirocco fans and the boilers are fed by four turbine pumps exhausting into feed heaters.

In the engine room there are five Parsons turbo-alternator sets. Each will provide a continuous output of 12,000 kW at 6,600 V, 3-phase, and an output of 20,000 kW for two minutes. The condensers are of the twin type. There are five circulating water pumps of the vertical centrifugal type. The condensing water pipes are being supplied by Messrs. Ashmore, Benson, Pease & Co., Ltd., and Messrs. Blakeborough & Co., Ltd. The transformer chambers are arranged to accommodate the static transformer sets, one being allocated to each generator unit. The normal output of each of these transformers is 500 kVA, the ratio of transformation being 6,600 to 415 volts. In addition, there are four station transformers, the capacity of each being 900 kVA. The transformers are being supplied by the Metropolitan-Vickers Electrical Co., Ltd. Messrs. A. Reyrolle & Co., Ltd., are supplying the switchgear. The switch house is 136 ft. long and forms an extension of the engine house. The coal and ash-handling plant has been ordered from Robert Dempster & Sons, Ltd., of Elland, and five step-up transformers, which will raise the voltage from 6,600 to 88,000, are being supplied by the International General Electric Co.

Twelve sub-stations are being erected. One of these will contain three motor-generator sets, seven will contain two sets, and the remaining four will each contain one set. The step-down transformers, lightning arresters, and switches are being supplied by the International General Electric Co., and the contract for the balance of the plant in the sub-stations has been secured by the British Thomson-Houston Co., Ltd. The transmission lines are being supplied by Messrs. Hubert Davies & Co., and the track structure is being built up in the country of Union materials by Messrs. Gilbert Hamer and Co., to the order of the British Insulated & Helsby Cables, Ltd.

Electric Vehicle Progress.—The St. Albans City Corporation has placed an order for a 3½-ton Garrett electric vehicle for refuse collecting, as a result of a recent demonstration which showed considerable saving on the cost of horse vehicle work, even after allowing for battery charging plant. The Southend Corporation Health Committee recommends that the order for three Garrett electric vehicles, costing £910 each, should be increased to four. The Corporation Tramway Committee has also recommended that an electric tower wagon for maintenance work should be purchased from Electricars, Ltd., at a cost of £995. The Hackney Borough Council is purchasing 20 Garrett electric vehicles for work on refuse disposal, with steel tub bodies by Messrs. Ransome & Rapier, Ltd., fitted suitably for lifting and tipping. The Grimsby Corporation uses a Clayton electric vehicle for street watering, the tank being removable. The same vehicle can be used for refuse collecting with the customary container.—*Electric Vehicle.*

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* Electrical Review *posted as to their movements.

Mr. Dewi Jones has been appointed by the Conway Town Council as resident electrical engineer, at a salary to be agreed upon by the Gas and Lighting Committee.

The Times states that Mr. Fredbric Richard Davenport has joined the board of the Brush Electrical Engineering Co., Ltd.

Mr. William H. Onken, Junr., editor of the *Electrical World*, is visiting this country in the course of a three months' tour. During this time Mr. Onken will visit the principal European countries whose development and use of electrical energy has assumed any considerable proportions. His visit will be for the purpose of obtaining first-hand information on electrical developments in Europe.

The *Commonwealth Engineer* for June stated that Mr. J. E. Donoghue, general manager and chief engineer of the Sydney Electric Light & Power Supply Corporation, Ltd., had left for London on the *Naldera*. He is making a tour of the United Kingdom and America. Mr. G. Allbut, manager of the Newcastle, N.S.W., electricity undertaking, will visit Great Britain next year to investigate electric lighting developments. The same contemporary states that Mr. Ernest G. B. Millar, chief engineer of the English Electric Co. of Australia, Ltd., has resigned his position. He was on the staff of Messrs. Geo. Weymouth Pty., Ltd., Richmond, Victoria, as electrical designer, and when that company became a subsidiary to the English Electric Co. of Australia he was transferred to Sydney as chief engineer. He was sent to the U.S.A. and to the English Electric Co., England, to study particularly American high-voltage transformer practice and also the methods of the English Electric Co. Upon his return he devoted his attention to the establishing of the transformer department, where the highest voltage and largest power transformers are designed and manufactured in Australia. Since then he has had control of the new Clyde works of the company, where an 18,750-kVA turbo-alternator is now being manufactured. Our contemporary expects to hear of Mr. Millar in a new important venture either in Sydney or Melbourne shortly.

Mr. T. A. Taylor, A.M.I.E.E., has resigned the appointment of mains assistant with the Fulham Borough Council and taken up his new duties as mains engineer with the County Borough of Hastings Electricity Department.

Mr. H. Fraser, of Stratford-on-Avon, has joined the Electrical Trades Supply, Ltd., Britannia Works, Birmingham, as sales representative.

Following upon a report by the chief electrical engineer, the St. Pancras B.C. Electricity Committee is considering the advisability of installing pulverised fuel plant at its King's Road power station in view of the economy and operating advantages which would be effected. In order to obtain first-hand information it recommends that the Chairman of the Committee and the chief electrical engineer be authorised to visit the United States to inspect plant in operation and obtain information. The cost of the visit is estimated at about £500. The Finance Committee, while supporting the recommendation, is in doubt whether the Government auditor would pass the expenditure and recommends that the Minister of Health be consulted. The matter was to come before the Council on Wednesday evening.

The St. Pancras Parliamentary and General Purposes Committee recommends that the position held by Mr. J. H. Bryan in the Electricity Department as sales engineer be abandoned and that the title of the appointment be "canvasser and consumers' adviser," and that the salary be increased from £325 to £350 per annum inclusive, and that it be not subject to any variation in the cost of living.

There are 45 applications for the position of mains superintendent to Blackburn Electricity Department rendered vacant by the death of Mr. Wallwork. A special committee is dealing with the matter.

Mr. Thomas Wilkie, who has been for fourteen years in the Lighting Department of Glasgow, has been appointed superintendent of lighting at Leicester at a salary of £400 per annum. This is in connection with the reorganisation of the Street Lighting Department.

Mr. F. A. Greene, consulting engineer, has removed from Upper Thames Street to 29, Bartholomew Close, E.C.

Mr. C. McCarthy-Jones, M.I.M.E., M.I.E.E., consulting engineer, who was retained by the Burmah Oil Co., Ltd., in connection with its scheme for the electrification of the Burma oilfields, has recently returned to London from a visit to the East. During his stay he witnessed the successful application of electrical power to all departments of the field system.

The *Journal* of the British Chamber of Commerce at Shanghai states that Mr. A. G. Henderson, of the Shanghai Electric Construction Co., Ltd., who had been transferred to Singapore, left for the southern port on May 12th. The arrangement between the Shanghai and Singapore companies is referred to in our "City Notes" to-day.

On July 16th, at Musselburgh, Scotland, the marriage took place between Mr. Harry Payn, engineer and manager of the Northwood Electric Light & Power Co., Ltd., and Miss Babb, eldest daughter of Mr. H. C. Babb, the general manager of the Lothians Electric Power Co. and the Musselburgh and District Electric Light & Traction Co.

Brighton Town Council, at its last meeting, says the *Sussex Daily News*, adopted the recommendation of the Lighting Committee increasing the basic salary of Mr. J. Christie, chief electrical engineer, from £1,100 to £1,450, the present bonus to be merged in this sum.

Obituary.—Rt. Hon. J. C. White.—We regret to learn of the death, in his 69th year, of the Rt. Hon. J. C. White, Craigavad, Co. Down, a solicitor, which took place after an operation last week. Our correspondent states that the deceased gentleman was a very ardent advocate of the extension of electrical power and lighting in Ireland. He was an ex-Lord Mayor of Belfast. His death followed close upon a recent visit to Dublin in connection with electrical development. He was a member of the committee which inquired into Irish Water Power Resources, and was recently identified with the scheme to establish an electricity generating station on the River Bann, utilising the resources of Lough Neagh for the lighting of several Ulster industrial districts.

Will.—Mr. John Taylor Osler, of Hampstead (eldest son of the late Mr. J. T. Osler, of Edgbaston), director of Messrs. F. and C. Osler, Ltd., electrical fittings manufacturers, Birmingham, left £78,160 gross.

NEW COMPANIES REGISTERED.

British Electrical Instruments, Ltd. (191,460).—Private company. Registered July 21st. Capital, £1,000 in £1 shares. To carry on the business of manufacturers of, agents for, and dealers in electrical and other instruments and appliances in connection with wireless telegraphy, telephony, and communications, &c. The permanent directors are:—S. Sharples, 38, Sandon Street, Blackburn; E. Sharples, 144, Stamford Street, Brook's Bar, Manchester; H. W. Taylor, "Amherst," York Road, Heaton Moor, Stockport. Qualification, £50. Remuneration, £10 per annum divided between them. Registered office: 79, Corporation Street, Manchester.

Renfield Engineering and Trading Co., Ltd. (12,787).—Private company. Registered in Edinburgh July 25th. Capital, £100 in £1 shares. To carry on the business of electrical engineers, manufacturers, suppliers, and hirers of films and all kinds of electrical apparatus, &c. The first directors are:—D. Small, 105, West George Street, Glasgow, consulting engineer; G. M. Brand, 74, Bath Street, Glasgow, architect; C. W. Townsend, Cove, Dumbartonshire. Registered office: 47, Renfrew Lane, Glasgow.

Petersfield Electric Light and Power Co., Ltd. (191,494).—Registered July 23rd. Capital, £20,000 in £1 shares (6,500 6 per cent. preference and 13,500 ordinary). To take over from R. G. Cross, T. A. Crawter, and C. W. Seward all their rights, benefits, and interests under an agreement with the Petersfield Urban District Council, to adopt an agreement with Crompton & Co., Ltd., and to carry on the business of an electric light company, &c. Minimum cash subscription, £8,000. The first directors are:—Dr. R. G. Cross, Shackleford House, Petersfield; E. J. Baker, High Street, Petersfield; P. C. Burley, 27, Lavant Street, Petersfield; T. A. Crawter, "Beechlands," Petersfield; D. E. Hobbs, Chapel Street, Petersfield; W. P. Jacobs, Ambleside, Petersfield; C. W. Seward, Borough House, Petersfield. Qualification, 200 shares, of which not less than 134 shall be ordinary. Secretary: H. H. Creedon. Registered office: 27, Lavant Street, Petersfield, Hants.

British Hush-a-Phone Co., Ltd. (191,522).—Private company. Registered July 25th. Capital, £250 in 1s. shares. To acquire the undertaking of the British Hush-a-Phone Co., and to carry on the business of suppliers of Hush-a-Phones and any articles or accessories capable of being used or utilised in connection with telephones, &c. The first directors are:—W. V. D'Arcy Rutherford, 2, West Chapel Street, Mayfair, W., merchant; E. A. P. Barlow, 16, Hyde Park Street, W.2, director of companies. Qualification, 500 shares. Registered office: 19, Berkeley Street, Berkeley Square, W.

Gardner & Pederson, Ltd. (191,483).—Private company. Registered July 23rd. Capital, £1,100 in £1 shares. To take over the business of manufacturing electricians, electrical engineers, and contractors carried on by W. C. Gardner, P. McGreevy, and O. Pedersen at 2a, Albert Street, Fleetwood, as Gardner & Pederson. The permanent directors are:—W. C. Gardner, 51, Charles Street, Blackpool; P. McGreevy, 63, Hilton Street, Fleetwood; O. Pederson, 31, Ashburton Road, Blackpool; A. E. Johnstone, "Fernleigh," Hastings Road, Poulton-le-Fylde. Qualification, £50. Remuneration, £5 each per annum. Secretary: A. E. Johnstone. Registered office: 2a, Albert Street, Fleetwood.

Hamilton Bros., Ltd. (191,509).—Private company. Registered July 24th. Capital, £300 in £1 shares. To carry on the business of electricians, mechanical engineers, and manufacturers, manufacturers of, and dealers in radio apparatus of all kinds, &c. The subscribers (each with one share) are:—R. Mooney, 2, Norfolk Road, Bayswater, W., wireless operator-mechanic; F. W. Kebbell, 31, Arcola Street, Kingsland Road, N., cycle mechanic. R. Mooney signs document as director. Qualification, 5 shares. Registered office: 113 and 114, Fenchurch Street, E.C.

W. G. Prosser & Co., Ltd. (191,572).—Private company. Registered July 28th. Capital, £3,000 in £1 shares. To acquire the business of electric welders and general engineers now carried on by W. G. Prosser and S. Machin at Bowesfield, Stockton-on-Tees, Durham, as "W. G. Prosser and Co.," and to carry on the business of electrical, oxy-acetylene, and general welders, cutters and engineers, specialists in engineering castings and repairs, &c. The permanent directors are:—W. G. Prosser, "Rose Cottage," Greatham, Stockton-on-Tees; S. Machin, 3, Atterby Terrace, Stockton-on-Tees. Qualification, £300.

J. Brent & Co., Ltd. (191,551).—Private company. Registered July 26th. Capital, £100 in £1 shares. To carry on the business of electricians and general dealers in goods manufactured in England or elsewhere. The subscribers (each with one share) are:—A. H. Cooper, "Beachdell," Rickmansworth Road, Watford, schoolmaster; S. F. Rous, 6, Cemmaes Terrace, Hemel Hempstead, schoolmaster. A. H. Cooper is first permanent director. Registered office: 2a, Marlborough Road, Watford.

Bournemouth Wireless Training College Co., Ltd. (191,433).—Private company. Registered July 20th. Capital, £6,000 in 4,000 ordinary shares of 10s. each and 4,000 participating preference shares of £1 each. To take over the business of a wireless engineer and dealer in accessories and spare parts carried on by J. R. Schofield at 20, Lansdowne Road, Bournemouth. The first directors are:—J. R. Schofield, Marconi House, Pencisely Road, Cardiff, managing director, South Wales and West of England Wireless Training College, Ltd. (managing director); H. Hamer, 1, Park Road, Beckenham Lodge, Bournemouth, head instructor above college. Remuneration as fixed by the company. Registered office: 20, Lansdowne Road, Bournemouth.

Hazeltine Neutrodyne Radio Sets, Ltd. (191,443).—Private company. Registered July 20th. Capital, £5,000 in £1 shares. To acquire the right to use an invention known as "The Hazeltine Neutrodyne Radio Receiver" in relation to radio-telephony and/or radio-telegraphy for the elimination of the effects of "capacity coupling" between two circuits, and to manufacture and deal in apparatus made in accordance with the said invention, &c. The first directors are:—J. C. Elms, 57, Hamilton Terrace, Orange, New Jersey, U.S.A.; A. H. Corwin, 19, East Highland Avenue, East Orange, New Jersey, U.S.A.; H. C. Elms, Junr., 57, Hamilton Terrace, Orange, New Jersey, U.S.A.; G. A. Mower, 14, Collingham Gardens, S.W.5; G. R. Thursfield, Oakley Street, Chelsea, S.W.3.; A. H. Curtis, "Caramore," Chances Road, Bedford. Qualification, £100. Remuneration as fixed by the company. Secretary: W. H. Ward. Registered office: 147, Queen Victoria Street, E.C.4.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Scarborough Electric Supply Co., Ltd.—Satisfaction in full on July 4th, 1923, of mortgage dated April 29th, 1921, securing balance owing on current account and other moneys.

Macartney, McElroy & Co., Ltd.—Particulars filed of £15,000 debentures authorised by resolutions of April 9th, May 23rd, and July 6th, 1923, charged on the company's undertaking and property, present and future, the amount of the present issue being £10,000.

Frank Craft (Castleford), Ltd.—Deposit on July 17th, 1923, of deeds of certain lands and premises in Methley Road, Whitwood Mere, near Castleford, Yorks., to secure all moneys due or to become due from company to Lloyd's Bank, not exceeding £800.

Cambrian Electrolytic Zinc Co., Ltd.—Particulars filed of £10,000 debentures authorised July 13th, 1923, charged on the company's undertaking and property, present and future, including uncalled capital, subject to outstanding debentures for £2,060, the amount of the present issue being £3,000.

Birmingham Central Supply Co., Ltd.—W. Lloyd, of 12, Cherry Street, Birmingham, was appointed receiver on July 12th, 1923, under powers contained in second mortgage debentures dated August 12th, 1922.

CITY NOTES.

Eastern Telegraph Co., Ltd.

The annual meeting was held on July 24th, Sir John Denison-Pender, G.B.E., K.C.M.G. (chairman) presiding. In presenting the report and accounts the chairman said that during the year trade had been generally depressed, and there was no better barometer of international trade than the receipts of the submarine telegraph companies. The receipts from messages showed a reduction of about £611,000 when compared with the preceding year, which might be attributed solely to the reduced traffic transmitted consequent upon the depression in trade, which prevailed generally during the year. They had, however, been able to maintain the dividend of 10 per cent. on the ordinary stock, to place £400,000 to the general reserve fund, and to carry forward a balance of £515,257. The success of the company and its associated companies had been largely due to the policy of building up the reserve funds, thus enabling them to lay additional cables as and when considered expedient. Since the armistice the company, in conjunction with the Eastern Extension Co., had laid an entirely new cable of large capacity to the Far East, in addition to which it had carried out extensive renewals to many of the main line sections. The cost to the company of these operations had been £5,293,745, of which £2,678,086 had been charged to the general reserve fund, and there was roughly £1,600,000 still held in suspense. This fund was £25,000 less than it was at the end of the year 1914, notwithstanding the substantial additions which had been made to it since then, and it was vital that the fund should be again built up as rapidly as possible.

In the current year there had been no improvement in trade as shown by the traffics up to the present. Better trade returns could not be anticipated until the present chaotic condition of European affairs resumed a more normal aspect. It was hoped that the economies which were being effected would in a measure meet the considerable decrease in income which was anticipated. Owing to the excellent margin of capacity for traffic which they had in the Mediterranean, they were shortly reducing the number of ships in those waters by not replacing at present those being put out of commission owing to their age, with a consequent reduction in working expenses. They had strengthened their system during the past year, at a cost of over one million pounds, by completing the laying of a new line between Malta and Colombo, connecting with the extensions made by other associated companies. The length of cable expended during the year for new cables and renewal of old ones reached the very large figure of about 4,500 miles. This increase in capacity would accelerate the dispatch of messages and thus minimise the use of urgent telegrams. All this expenditure had been made without any increase in rates; indeed, in some cases, rates had been materially reduced. The installation of new and improved apparatus was being rapidly developed—the use of these special instruments had not only reduced delay and the number of errors to a minimum, but had given, for instance, direct communication between this country and Australasia without the intervention of the human element by way of transmission at intermediate stations, whereby the signals as they left London were reproduced automatically in Melbourne or Sydney.

It had been found inadvisable to resume the week-end quarter-rate telegram service; in its place a system of plain language cable letter telegrams was being introduced, acceptable for transmission on any day of the week excluding Sunday, with normal delivery after forty-eight hours, the rate of charge to be one-quarter of the ordinary rate with the minimum charge of twenty words.

During the past year the question of the readjustment of capital had received the careful consideration of the directors, but it was considered inadvisable to recommend or make alterations.

Reviewing the position with regard to radio-telegraphy, the chairman said that Italy, the home of radio-telegraphy, was floating a company with a capital of £2,000,000 for the purpose of laying cables between Italy and North America, and Italy and South America. The American companies were also entering into active competition with each other for the laying of large cables to supplement their existing lines, and, indeed, one of these companies had a cable loaded ready for laying, which, taking into consideration its length, was the most expensive ever yet manufactured in this country. The Pacific Cable Board was now engaged in duplicating part of its Australian lines by laying new cables between Sydney and Brisbane and from Fiji to Auckland. Germany was actively engaged in negotiations for relaying her extensive system of cables, and even extending those she had prior to the war. These nations and organisations would not risk the expenditure of such vast sums of capital in cable enterprise unless they were confident that cable systems of communication all over the civilised world must continue. At the same time, the board held the opinion that it should be connected with all classes of telegraphic communication, and with this object it was associated with applications for wireless licences for full-powered stations in Great Britain, India and China.

In conclusion, the speaker announced that Mr. Edward Wilshaw was appointed secretary upon Mr. Hardie's joining the board. Mr. Wilshaw entered the service in 1894, had worked his way through all the most important commercial departments, and was well qualified to fill the position.

The report and accounts were adopted.

Kalgoorlie Electric Tramways, Ltd.

The annual meeting of this company (whose report and accounts were reviewed in our last issue) was held on July 25th. Mr. A. P. H. Stoneham, who presided, referred to the attitude of the Labour Party, which he said showed several signs of improvement. This would encourage the mining companies to undertake further developments and to employ more men, thus increasing the company's traffic. At the last meeting he had referred to the expiration of the company's agreement with the men. As a result of meetings held between the men's representatives and Mr. Stanley it had been agreed to continue the existing conditions for another year, *i.e.*, to June 30th last, and this arrangement proved very satisfactory. They did not know what attitude the men would take up with regard to any new working conditions, but the company hoped to be able to come to some reasonable arrangement with them, as they appeared to be satisfied with the present position.

They had hoped to show a substantial improvement this year, but the long strike of the engineers and the consequent restriction of mining operations were responsible for a falling-off in traffic. They had gone as far as they could go in the matter of economies, consistent with the maintenance of an efficient service and they could only hope that some discovery would be made at Kalgoorlie to restore it to the position which it held when the tramways were constructed.

Eastern Extension, Australasia and China Telegraph Co., Ltd.

The annual meeting was held on July 25th; Sir John Denison-Pender, G.B.E., K.C.M.G., presided. The chairman said that he considered the results quite satisfactory, although, as compared with 1921, there was a net decrease of £402,297. Message and other receipts had again fallen. Working expenses were much in excess of those of 1913 (about 20 per cent.), but having now been relieved of many items of expenditure rendered necessary during the past few years, they should, before long, assume a more proportional standard to receipts. A net increase in general expenses at stations, amounting to £47,498, was mainly accounted for by the very considerable increase in income tax, due to the introduction in the Netherlands Indies of a revised system of taxation, against which strong objection had been raised by all firms trading in that country. There was an increase in home taxation of £46,413, due to the fact that under the three years' average system in the computation of the income tax for 1922, one lean year was dropped and one fat year had to be substituted, thus increasing the taxable amount by about £204,000. The balance was £724,803, plus the carry forward from 1921 of £307,880, making a total of £1,032,683. From this sum £250,000 had been placed to the general reserve fund; £400,000 paid in dividends; and the balance, £382,683, carried forward. It was considered advisable to carry forward this substantial amount, in view of the fact that returns for the early months of the current year showed a further considerable fall in traffic receipts. It would be some years before any improvement took place in the Chinese situation, and, needless to say, trade suffered. The laying of a cable between Colombo and Penang was successfully accomplished in March last, and the cable had been working well and efficiently since that date. Owing to increased shipping activities at the port of Penang, and the area of the harbour there becoming congested with their many shore-ends, it became necessary to make an alteration in order to secure cables from such interruptions as had recently occurred through ships anchoring in their vicinity. With the assistance rendered by the Colonial Office, and the Government of the Straits Settlements, a suitable landing place, six miles distant from the harbour, was secured, to which six cable shore-ends had been removed, leaving only five in the harbour. In order to improve communication between Singapore and Java, it had been decided to duplicate the Singapore-Batavia cable. This work would be completed when the company obtained the necessary permission from the Netherlands Indian Government to land the second cable. In the unlikely event of such permission being refused the company would substitute the new cable for the existing Singapore-Batavia section. The latter having been laid for many years, this part of the system must be strengthened. The Great Northern Telegraph Co.'s route between Europe and the Far East had worked satisfactorily since February, 1922, thus helping to lessen any congestion of traffic on the company's lines and enabling it to reduce delay in transmission.

Referring to the question of the rearrangement of the shares of the company, the chairman said that the directors and auditors had carefully considered the matter, and had come to the decision that any alteration at the present moment would be inadvisable. To celebrate the fiftieth anniversary of the incorporation of the Eastern Associated Telegraph Companies the directors authorised the grant of two months' pay to the staff and pensioners. In conclusion the speaker referred to the continued loyal co-operation and good work rendered by the members of the staff at home and abroad during the past year.

The report and accounts were adopted.

North of Scotland Electric Light and Power Co., Ltd.

In their report for the year ended December, 1922, the directors state that the connections in Montrose increased from 1,849 kW to 1,945 kW, in Brechin from 934 kW to 956 kW, and in Inverness from 2,513 kW to 2,698 kW, making a total of 5,599 kW connected in the three towns. After making provision for income tax and reserve for renewal of plant, and meeting debenture and loan interest, and preference share dividend, and adding the amount brought forward, the balance of net revenue is £4,783. A dividend of 7 per cent. on the ordinary shares, free of income tax, is recommended, absorbing £3,500; £1,000 to general reserve account; £283 carried forward.

Electrical Distribution of Yorkshire, Ltd.

During the half-year ended June 30th there was a satisfactory increase in the demand for electricity and a substantial addition to the number of consumers. An interim dividend at the rate of 7 per cent. per annum (free of tax) is to be paid for the six months. The development of the business and decreased costs have enabled the directors to reduce the price of supply to consumers in all those districts where the tenure is long enough to justify the anticipation of a reasonable return on additional capital expenditure on extensions contemplated in those districts. At meetings in March the nominal capital was increased from £150,000 to £250,000. Further capital is not yet required; an issue will be made to the shareholders early next year.

Greenwood and Batley, Ltd.

Col. O. C. Armstrong, D.S.O., presiding at the annual meeting on July 24th said that owing largely to trade disputes the results in 1922 compared unfavourably with those of the previous year. The works had been occupied in disposing of old orders; new orders were slow in coming to hand. He did not think that the adjustment of international affairs would have the immediate beneficial effect upon trade which some people anticipated; very keen foreign competition would have to be met and the backing of Labour was essential to success. The first part of the current year showed an improvement in the number of orders received.

Fellows Magneto Co., Ltd.

Presiding at the annual meeting on July 26th, Mr. V. L. Fellows (chairman) said that a small profit (£1,025) had been earned in 1922, as compared with a loss of £49,000 in the previous year. The severe price-cutting in the motor-car industry had also affected accessories, and although the cost of production had been reduced, the margin was not so great as it should have been. The company was now manufacturing radio apparatus on a large scale, and it was hoped that the existing slump in sales would pass over with the advent of another winter. This branch of the business fitted in exactly with the falling-off in the sales of magnetos which occurred in the winter.

Austrian Marconi Company.

The Oesterreichische Marconi Aktien Gesellschaft, which was formally constituted in Vienna on July 13th, with a capital of £133,000, has registered offices at Renn Gasse 14, Vienna. The majority of the board, and the entire staff, are Austrians. Baron Carl Pitner, formerly Governor of the Bosnian Bank, is chairman of the board, and other members are: Herr Hans von Mauthner, vice-president of the Austrian Credit-Anstalt; Herr M. Straffner, member of the Austrian Council of State; Consul-General Richard Fanta (Wiener Bankverein);; Privy-Councillor Zeisel (representing the Austrian Ministry of Commerce); Ministerial-Councillor Haider (representing the Austrian Telegraph Administration); Herr Fritz von Kammann; and Colonel Adrian Simpson, C.M.G. The Austrian Government has subscribed £40,000 towards the share capital. The company has the sole right of carrying on radio-telegraphic services between Austria and other countries for a minimum period of thirty years. The rates will be the same as for ordinary telegrams. Several new stations will be opened for traffic before the end of the year.

Para Telephone Co.

According to the *Financial News*, the report for 1922, presented at the meeting held on July 23rd, stated that after writing off £6,804, loss on exchange, &c., and allowing £1,808 for income tax, corporation profits tax, and excess profits duty charges, the net profit for the year was £2,883. £4,457 was brought in, making £7,300, which is being carried forward. There was no improvement in Brazilian exchange during the year, and the company suffered very heavily through the continued depreciation, £6,804 having been written off as mentioned above. Owing entirely to this cause, the directors regret they are unable to recommend the payment of a dividend. The revenue in Para shows an increase of over £1,300 on the year's trading, due to the increase in telephone subscriptions. The number of subscribers on December 31st, 1922, was 1,401, an increase of 132 lines for the year.

German Companies.

The *Concordia Electricity Co.*, of Dusseldorf, reports an improvement in technical production and sales in 1922. The net profits amounted to 114.194 millions of marks, of which the dividend absorbs 90 millions.

The *Bank for Electrical Values*, of Berlin, which has share interests in the A.E.G. and in undertakings closely associated with the latter, proposes to increase the share capital by 303 to 500 millions of marks for the extension of the company's activity.

Marconi's Wireless Telegraph Co., Ltd.—With reference to the statement made to the House of Commons by H.M. Postmaster-General with regard to the agreement now under negotiation between H.M. Government and the Marconi Co. for the provision of an Empire wireless telegraph service and the granting of a general licence for a world wireless telegraph service, the directors announce that they have decided to defer the annual meeting so that they may be in a position to give detailed information with regard to the agreement. The audit of the accounts for the year is not yet complete, but the profit will not be less than that of the preceding year.

Liverpool Overhead Railway Co.—Interim dividend for the half-year ended June 30th at the rate of 5 per cent. per annum on the preference shares. Income tax at the rate of 4s. 7½d. in the £ will be deducted.

Northampton Electric Light and Power Co., Ltd.—Interim dividends of 2½ per cent. on the 5 per cent. preference "B" shares and 4 per cent. on the ordinary "B" shares.

Rushden and District Electric Supply Co., Ltd.—Interim dividend of 3½ per cent. for the year on the share capital.

Companies Struck off the Register.—The following companies have been struck off the register and are thereby dissolved:—

Appareil Magnétique, Ltd.
Rotherham Electrical Engineering Co., Ltd.
Steel's Electric & Engineering Co., Ltd.
Accessories Manufacturing Co., Ltd. (registered March 31st, 1905).
F. Husband, Ltd.
Universal Cable Code (Parent) Co., Ltd.

Singapore Electric Tramways, Ltd.—At a meeting of debenture-holders, held on Monday, a resolution was passed approving a scheme entered into by Sir W. Plender, the receiver, with the Shanghai Electric Construction Co., Ltd. Sir W. Plender, in advising the adoption of the scheme, said that its underlying idea was co-operation between the two companies. He added, according to the *Financier*, that the proposed issue of £250,000 debentures should be sufficient to rehabilitate the system and provide working capital. It was proposed to adopt the railless trolley system.

Yorkshire Electric Power Co.—During the half-year ended June 30th, the sale of electricity again largely increased, this being mainly due to the demands from new consumers. The profits also showed a satisfactory increase. Interim dividend at the rate of 6 per cent. per annum. The issue in April last of £250,000 of ordinary shares of £1 each at 23s. per share was applied for more than three times over by the shareholders.

Brazilian Traction, Light, and Power Co., Ltd.—The annual meeting was held in Toronto on July 24th. Sir William Mackenzie, chairman, in moving the adoption of the report, pointed out that the results for 1922 might be considered satisfactory having regard to conditions in Brazil and the low rate of exchange prevailing during the period under review.

Metropolitan Railway Co.—Interim dividend at the rate of 3 per cent. per annum on the ordinary stock for the half year ended June 30th.

Stock Exchange Notices.—Dealings in the following have been specially allowed by the Committee under Rule 159:—

Smithfield Markets Electric Supply Co.—60,000 ordinary shares of £1 each, fully paid, Nos. 1 to 60,000.

The undermenticned have been ordered to be officially quoted:—

Delhi Electric Tramways and Lighting.—100,000 6 per cent. preferred and participating shares of £1 each, fully paid, Nos. 1 to 100,000.

Smithfield Markets Electric Supply Co.—60,000 ordinary shares of £1 each, fully paid, Nos. 1 to 60,000.

Isle of Thanet Electric Tramways and Lighting Co., Ltd.—The financial Press states that a dividend of 2s. 6d. per share, less tax, on the preference shares for the half-year to October, 1909, has been paid.

A Swiss Investment Co.—The Watt Co. for Electrical Undertakings, which belongs to the group of the Zurich Bank for Electrical Undertakings, reports that it is again unable to pay interest on the obligation loan of 7,000,000 fr. The debit balance remains at 2,900,000 fr.

Charing Cross, West End, and City Electricity Supply Co., Ltd.—Interim dividend of 5s. per share on the ordinary shares of the West End Undertakings for the half-year ended June 30th, 1923.

Chelsea Electricity Supply Co., Ltd.—Interim dividend of 9 per cent. per annum, less tax, on the ordinary shares for the half-year.

City of London Electric Lighting Co., Ltd.—Interim dividend of 10 per cent. per annum, less tax, on the ordinary shares for the half-year.

City of Buenos Ayres Tramways Co. (1904), Ltd.—Dividend of 1s. 3d. per share, being at the rate of 5 per cent. per annum, less tax, for three months ended June 30th.

Bristol Tramways and Carriage Co., Ltd.—Interim dividend for the half-year ended June 30th, 1923, at the rate of 3 per cent. (less income tax) on the ordinary shares.

Clyde Valley Electrical Power Co.—Interim dividend of 3 per cent. actual on the ordinary shares.

Westminster Electric Supply Corporation, Ltd.—Interim dividend of 4s. 6d. per share for the half-year, the same as a year ago.

Bristol Tramways & Carriage Co., Ltd.—Interim dividend at the rate of 3 per cent., less tax, on the ordinary shares for the half-year.

STOCKS AND SHARES.

Tuesday Evening.

The week before August Bank Holiday is not expected as a rule to yield much grist to Stock Exchange mills, and it cannot be said that this year it has shown any break in the ordinary course of convention. Business is very quiet, and the tendency is to wait upon political developments abroad. Prices are inclined to move rather sharply, showing that

little demand on the one hand, and a little selling on the other, has a disproportionate effect. The general tendency of the week has been towards lower prices in most departments of the Stock Exchange.

Metropolitan Consolidated ordinary has been over 70, but came back to 69. The interim dividend is 1¼ per cent. actual, or 5s. per cent. more than that of a year ago, a somewhat disappointing result to those who were looking for 2 per cent. Nevertheless, the expectation which still prevails of the Metropolitan Railway coming into closer association with the Great Western serves to encourage a modest amount of hopefulness. Districts are 10s. lower; the Underground group itself is steady. The protests of Morden and other districts have had their effect, and the City & South London line is to be extended, the Southern Railway having withdrawn its opposition. This points to a probable new issue of stock in the comparatively near future. Possibly it will take the shape of some Government-guaranteed security on similar lines to those which were given when the Central London, and other tube companies, raised fresh capital some time ago.

In addition to the electricity supply companies which have raised their interim dividends, and to which reference has already been made here, the Chelsea company has announced 4½ per cent. actual for its interim dividend, against 4 per cent. for a year ago. The City of London company maintains its 5 per cent., the same as was declared twelve months back. The market in electricity shares is quiet; business has drifted into narrow channels. Of the foreign issues, City of Tokio Electric Sixes are easier at 5s. premium; the Lima debentures remain dull at 1½ discount. Enfield Ediswan Cable Works 7½ per cent. preference are quoted at 1s. 3d. discount, and the new 6 per cent. preference shares of the Electric Supply Corporation, issued at £1 and with 5s. paid, are obtainable at 3d. discount. English Electric 6 per cent. convertible debenture stock, which came out at 97, and upon which there is now 37 per cent. paid, stands at 4½ premium, and can be bought about 102 fully paid, giving a return of £5 17s. per cent. on the money, with a broken interest payment of £2 4s. per cent., payable on January 1st next. It may be useful to recall that each £100 of this debenture stock is convertible up to July, 1927, into 100 ordinary shares; in July, 1930, into 90 ordinary shares; and in July, 1933, into 80 ordinary shares.

County of London ordinary strengthened to 38s. 9d. upon consideration of the increased interim dividend. Westminsters, Londons and South Londons are all a little lower on the week.

One of the firm features in the Stock Exchange is the market for Marconi shares. The price spurted from 2¼ to 48s. 9d., and has held its improvement. The rise is due, of course, to the statement made in the House of Commons the other night with reference to the more energetic programme which is about to be taken in hand in connection with the Government's scheme of a wireless chain. Moreover, a recent Post Office Vote is thought likely to prelude a payment to the Marconi company of compensation, or remuneration, for work done by the company during the war. The preference shares have improved a little in sympathy. Canadian Marconis are steady at 8s. 3d.; Radio Corporation shares hardened to 14s. for the common, 14s. 6d. for the preferred. Oriental Telephones at 2 are ex rights, the latter being valued at 12s. 6d. Chile Telephones at 6½ recovered the dividend of 3s. deducted last week.

The Eastern Telegraph group is a little easier, Eastern Extensions, Globe ordinary, and Westerns giving way to 17½, while Globe preference lost ¼ at 11¼. Indo-Europeans are another £1 to the good, thanks to the issue of the circular to which attention was drawn here last week, in which the company stated that through traffic to Teheran was about to be reinstated. Automatic Telephones rose to 19s., which had the effect of causing International Automatic Telephones to harden also, the latter being 12s. 9d. The Anglo-American cable group is steady.

Anglo-Argentine Tramways first preference are heavy at 3½, and the seconds fell to 2 9/16, but the 5 per cent. debenture stock regained 10s. of its last week's fall, and now stands at 74½. Brazil Tractions at 49½ are ex dividend. British Columbia deferred rose a point. Renewed heaviness is the only feature amongst Mexican securities; the Tramways 6 per cent. bonds are 2 lower at 56½, and the fives at 76 have failed to recover from their sharp drop of a week ago. The Tramway section as a whole is dull and rather uninteresting. Georgia Light & Power common shares, after their rise from 4 to 15, went back a couple of points, evidently on sales by people ready to take a profit.

Siemens at 13s. 9d. have recovered a little after their heavy drop. General Electric ordinary at 18s. 6d. are ex dividend. Babcocks remain somewhat dull at 44s. 4½d. Telegraph Manufacturing remain at 16s.; Johnson & Phillips are 16s. 6d. Other manufacturing shares are quiet, and Edisons are quoted 4s. 3d. middle. The rubber market showed a strong tendency for a few days, thanks to a recovery in the price of the raw produce. The market, however, found it hard to fight against the general depression which settled over most sections of the Stock Exchange, with the consequence that prices went back from the best. Iron and steel shares exhibit little animation. What few movements occurred were mostly microscopic falls.

SHARE LIST OF ELECTRICAL COMPANIES

Home Electricity Companies.

	Nom.	Dividend. 1921.	Dividend. 1922.	Price July 31. 1923.	Rise or fall.	Yield p.c.
	£					
Brompton Ordinary	1	12	12	1 1/16	—	£6 2 6
Charing Cross Ordinary ...	5	9	14	11½	—	6 4 6
do. do. do. 4½ Pref.	5	4½	4½	4⅞	—	5 2 10
Chelsea	1	6	10	34/-	—	5 17 6
City of London	1	14	15	2 5/16	—	6 9 10
do. do. 6 % Pref. ...	1	6	6	24/-	—	5 4 4
County of London	1	8	10	38/9	+9d.	5 3 3
do. do. 6 % Pref. ...	1	6	6	23/9	—	5 1 1
Edmundson's Ordinary	8	Nil	7	3	—	7 0 0
do. 6 % Pref. ...	5	12/-	6	4⅞	—	6 3 6
Kensington Ordinary	5	10	12	9½xd	— ½	6 11 4
London Electric	8	4	10	4½	— ½	7 1 7
do. do. 6 % Pref. ...	5	6	6	5⅝	—	5 11 7
Metropolitan	1	7	8½	31/3	—	5 8 7
do. 4½ % Pref.	1	4½	4½	17/6	—	5 1 6
Newcastle-on-Tyne Ordinary ...	1	Nil	2½	17/-	—	2 19 10
do. 5 % Pref. ...	1	5	5	16/3	—	6 3 1
do. 7 % Pref. ...	1	7	7	24/-	—	5 16 8
Notting Hill, 6 per cent. Pref....	10	6	6	9½	—	6 9 9
North Met. Elec., 6 % Pref. ...	1	6	6	22/-	—	5 9 1
Urban Ordinary	1	Nil	—	15/-	—	Nil
do. 5 % Pref. ...	1	2½	5	18/9	—	6 8 0
St. James' and Pall Mall ...	5	12	14½	11⅝xd	—	6 4 9
South London	1	7	10	1⅞	— 1/16	5 14 4
South Metropolitan Pref. ...	1	7	7	1⅛	—	5 12 0
Westminster Ordinary	5	10	12	9½	— ½	6 9 9
Whitehall Elec. Invst., 7½ % Pf.	1	7½	7½	19/9	—	7 13 10

Home Rails.

Central London Ord. Assented	Stock	4	4	7¼	—	5 8 1
Metropolitan	,,	2½	3½	69	—1	5 1 5
do. District	,,	1	3	48	— ½	6 5 0
Underground Electric Ordinary	10	Nil	Nil	2⅞	—	Nil
do. do. "A" ...	1	Nil	Nil	8/6	—	Nil
do. do. Income	Stock	4	5	98	—	*5 2 0

Telegraphs and Telephones.

Anglo-Am. Tel. Pref.	Stock	6	6	103	—	5 16 6
do. Def.	,,	1½	34/6	23½	—	6 7 8
Chile Telephone	5	6	6	6½xd	+3/-	4 18 0
Cuba Sub. Ord.	10	7	7	7½	—	9 6 8
Eastern Extension	10	10	10	17½	— ½	5 14 3
Eastern Tel. Ord....	Stock	10	10	178½	—	5 12 1
Globe Tel. and T. Ord.	10	10	10	17½	— ⅛	5 14 3
do. do. Pref....	10	6	6	11¼	— ¼	5 6 6
Great Northern Tel.	10	24	22	27½	—	8 1 6
Indo-European	25	10	7	33½	+1	5 4 6
Marconi	1	25	15	2 5/16	+ 1/16	6 3 4
Oriental Telephone Ord. ...	1	12	12	2xd	—	*6 0 0
United R. Plate Tel.	5	8	8	6⅞	—	*5 16 4
West India and Panama ...	10	Nil	Nil	1/6	—	Nil
Western Telegraph	10	10	10	17½	— ¼	*5 14 2

Home and Foreign Trams, &c.

Anglo-Arg. Trams. First Pref.	5	5½	12½	3¾	— ¼	8 16 0
do. do. 2nd Pref.	5	Nil	5½	2 3/16	— 1/16	10 14 8
do. do. 5 % Deb.	Stock	5	5	74½	+ ½	6 13 6
British Electric Traction Ord.	,,	4½	5	73½	—	6 16 1
do. do. 6 % Pref.	,,	6	6	100	—	6 0 0
Brazil Tractions...	100	Nil	4	49½xd	—	8 1 8
Brit. Columbia Elec. Rly. Pcc.	Stock	5	5	85½	—	5 15 7
do. do. Preferred	,,	5	96/-	81½	—	*5 18 9
do. do. Deferred	,,	8	127/-	80½	+1	*7 2 6
do. do. Deb. ...	,,	4½	4½	81	—	5 5 0
Lond. & Sub. Trac. 5 % Pref.	1	3½	5	10/-	—	10 0 0
London United Tram. Deb. ...	Stock	4	4	61½	—	6 10 0
Mexico Tram. 5 % Bonds ...	—	Nil	Nil	76	—	6 11 7
do. 6 % Bonds ...	—	Nil	Nil	56½	—2	Nil
Mexican Light Common ...	100	Nil	Nil	23½	—	Nil
do. Pref.	100	Nil	Nil	58	—	Nil
do. 1st Bonds ...	—	Nil	5	65½	—	7 13 0

Manufacturing Companies.

Babcock & Wilcox	1	15	20	2 7/16	—	4 10 0
British Aluminium Ord. ...	1	10	5	18/9	—	5 6 5
British Insulated Ord.	1	15	15	21½	—	6 5 0
Callenders...	1	15	15	2½	—	6 0 0
do. 6½ Pref.	1	6½	6½	23/9	—	5 9 1
Crompton Ord.	1	10	5	7/16	—	5 17 6
Edison-Swan	1	10	Nil	4/3	—	Nil
do. do. 5 % Deb.	Stock	5	5	65	—	7 13 0
Electric Construction	1	10	10	1½	—	6 16 1
English Electric	1	8	5	17/9	—	5 12 8
do. do. Pref.	1	6	6	19/-	—	6 6 4
Gen. Elec. Pref.	1	6½	6½	23/3	—	5 11 10
do. Ord.	1	10	5	18/6xd	—	5 6 3
Henley	1	15	15	2½	—	6 6 4
do. 4½ Pref.	5	4½	4½	4⅝	—	5 9 10
India-Rubber	1	10	—	7/16	—	—
Met.-Vickers Pref.	2	8	8	9½	—	6 8 0
Siemens Ord.	1	10	10	13/9	+ 1/16	Nil
Telegraph Con.	12	20	20	20½	—	*4 16 0

* Dividends paid free of Income Tax.

NOTES ON THE AIR GAP OF INDUCTION MOTORS.

By H. WADDICOR, B.Sc.

In modern induction motors the length of air gap is usually fixed from mechanical considerations, being cut down to as small a value as is compatible with securing a safe clearance in the stator tunnel. This is done in order to obtain the highest possible efficiency and power factor from a machine constructed of a given weight of active material. It consequently behoves all persons responsible for the selection and upkeep of this type of motor to see (1) that the machine on purchase has an air-gap length of reasonable magnitude, or, in other words, the clearance should not be cut so fine, in order to obtain the guaranteed performance, that a reasonable wear of the bearing bushes cannot be obtained. (2) Furthermore, the gap should be as uniform as possible all the way round. If there is any considerable eccentricity, the operating characteristics of the machine will be injured, and, in the case of wound rotors having a single-circuit winding per phase, a large unbalanced magnetic pull introduced.

Dimensions of Gap.—Considerable difference is found between the air-gap length allowed by different manufacturing firms for the same size of motor. Many factors have to be taken into account when fixing this dimension, the chief being—

(1) Type of bearing—ordinary bush or ball bearing—finer values, of course, obtaining with the latter type.

(2) Stiffness of shaft and frame, and value of unbalanced magnetic pull (if any) for a given displacement of rotor.

(3) Diameter of rotor and distance between centres of bearings.

(4) Quality of workmanship on surfaces of rotor and stator.

The writer has had occasion recently to take measurements of well over 1,000 motors, of all sizes, and fairly representative of English manufacturing firms, and finds that the following empirical formula gives results which accord well with modern practice:—

Length of single air gap in inches $= .004\ D^1$,

D being the rotor diameter in inches.

Causes of Ununiformity.—Ununiformity of air gap may be caused by—

(1) Eccentricity of rotor surface with axis of shaft due either to the laminations being badly keyed on to the spider, or the shaft being sprung.

(2) Eccentricity of stator surface with axis of shaft due to defective setting of the end plates of the motor, or the pedestal bearings being badly lined up, according to the type of construction.

(3) Wear of bearing bushes.

In the case of a new or re-bushed machine, in order to ascertain whether (1) or (2) exists, measurements should be made as follows:—*

(1) Make a chalk mark on the rotor spider at one point A; check clearances at four points of the gap 90 deg. apart, with rotor stationary, A being one of the points.

(2) Check clearances at same four points on stator surface, but turning the rotor through 90 deg. each time so as to use the same point (A) of the rotor surface for each measurement.

Referring to fig. 1, where corresponding points of the rotor and stator, 90 deg. apart, are denoted by A, B, C, D, and A^1, B^1, C^1, and D^1 respectively, in the first case we measure AA^1, BB^1, CC^1, and DD^1. In the second case we measure AA^1, AB^1, AC^1, and AD^1. It is readily seen that if there exists any eccentricity of rotor, AA^1, BB^1, CC^1, and DD^1 will be unequal, and AA^1, AB^1, AC^1, and AD^1 will be equal. If, however, the stator is eccentric, AA^1, BB^1, CC^1, and DD^1 will be unequal; AA^1, AB^1, AC^1, and AD^1 will also be unequal.

It is thus fairly easy from the above series of measurements to determine the nature and magnitude of the defect, and steps can be taken to correct it.

Equalisation of Air Gap when Rotor is Eccentric.—If eccentricity is due to a sprung shaft, possibly a new one will have to be fitted, although in some cases the shaft may be straightened by judiciously bending it in the right direction, without the necessity of removing the spider. In other cases of rotor eccentricity, there are in general two methods of correcting for the defect: (1) Re-grinding of the rotor surface; (2) re-turning of the journals concentric with the rotor surface.

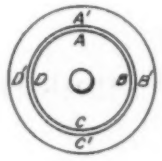

FIG. 1.

The first method may be used in the case of small machines, but involves lowering the value of the efficiency, power factor, and the pull-out torque of the motor. The second method is of wider application, and does not weaken the performance of the motor, but necessitates having the machine re-bushed.

Equalisation of Air Gap when Stator is Eccentric.—In machines of the type where a cast-iron end plate bolted to the frame supports the bearing housing, uniformity of gap may be obtained by turning the inside of the bush eccentric to the outside just of sufficient magnitude to correct the original error. In this connection it may be noted that some manufacturing firms provide an easy and accurate means of centring the shaft in the stator tunnel by fitting adjusting screws or bolts on the periphery of the end plates. In the case of motors having pedestal bearings, stator eccentricity is due to the bearings being badly lined up, and the remedy is obvious.

Periodical Measurement of Machines.—In the majority of cases it will be found that the air-gap is reasonably uniform without any correction being necessary, and machines may be put in commission straight away. The sole cause of unequal clearance between rotor and stator is then the progressive wear of the bearing bushes as time goes on, and it is exceedingly important to check the air-gap regularly (say every month) in order to determine when it is necessary to have the bushes renewed. Generally speaking, the wear of the driving end bush is far more rapid than that at the other end of the shaft, due to the higher stresses involved; and, in consequence, it is preferable to take all measurements at this end of the motor. Two measurements are usually sufficient, *viz.*, that of the minimum clearance and that of the maximum clearance diametrically opposite. The point of minimum clearance is found by trial, but it is usually easy to see from the direction of the drive its approximate position. The wear of the bush is in a definite direction, determined by the resultant of the pressures due to the load and the weight of the rotor respectively. For instance, if fig. 1 represents the pulley end of a motor, the belt drive being to the right and horizontal, it is easy to see that the minimum clearance will occur somewhere in that part of the gap between BB^1 and CC^1.

If l_1 = maximum clearance,

l_2 = minimum clearance,

* A 12-in. set of feeler gauges, with blades capable of measuring from 0.004 in. to 0.055 in., will be found the most generally useful for this purpose.

then $\frac{1}{2}(l_1 \times l_2)$ = length of air gap before any wear of bushes,

$\frac{1}{2}(l_1+l_2)-l_2$ = displacement of rotor,

and eccentricity,

$$\epsilon = \frac{\frac{1}{2}(l_1 + l_2) - l_2}{\frac{1}{2}(l_1 + l_2)} = \frac{l_1 - l_2}{l_1 + l_2}$$

Rebushing is advisable when ϵ attains the value of, say, 0.5.

There are one or two cases where an examination of the air gap, whilst the motor is at rest, does not give a reliable indication of its condition whilst actually running. For example, if the drive is by belt and vertically upwards, the pull on the belt due to the load is generally far greater in magnitude than the weight acting downwards at the pulley end bearing, and in consequence the wear of the bush will be at the top. When the machine is at rest, however, the tension on the belt is so reduced that the rotor sinks down, the pulley end journal resting on the bottom of the bush or in an intermediate position. Again, if the drive is by pinion and spur wheel, the pressure due to the load may cause the top half of the pinion end bush to be worn, although when at rest the rotor sinks and may appear perfectly central. A case of a 100-h.p. motor with spur gearing drive is on record where fouling occurred, although the day before the accident the clearance at the top was .030". It appears desirable, therefore, that in addition to the checking of the air gap by feeler gauge, a visual examination should be made occasionally whilst the machine is running. From this point of view, that type of construction which permits of actual inspection of practically all the air gap is to be preferred. The best way to conduct this inspection is to arrange a bright and uniformly illuminated surface (not a lamp, as this produces an optical illusion) at one end of the motor, the eye being placed at the opposite end so as to look through all portions of the gap in turn. A serious amount of ununiformity can readily be detected by this method.

THE DIRECT REDUCTION OF IRON ORES IN THE ELECTRIC FURNACE.

By WILLIAM MASON.

The Chaplet Neo-Metallurgie furnace is used in France for the direct reduction of iron ores. Its design is shown in fig. 1. The furnace works similarly to a small blast furnace where there is also a separate reducing and fusion zone. It is an arc furnace. The current enters through one or more vertical electrodes and leaves through one or more side channels B. The latter are

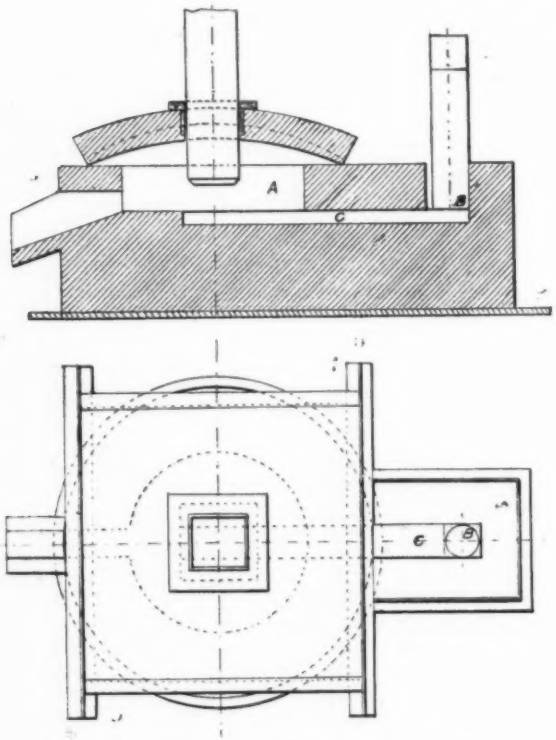

Fig. 1.—The Chaplet Neo-Metallurgie Furnace.

connected with the main bath A by horizontal channels C below the level of the bath. The slag is charged first, then the ore to be reduced mixed with carbon in proper proportions. Then the reduction begins under the action of the arc, and the reduced metal filters through the slag and collects on the bottom. The slag contains in normal operation less than 8 per cent. of iron oxide. In experiments with this furnace, in which more than 15 tons of metal was produced, the charge was a mixture of hematite ore and dried, powdered charcoal. Dried hematite briquets and wood charcoal and, later, mixtures of carbon and hematite in the form of powdered dust were also tried.

With ore and carbon the furnace produced 77 lb. of iron per hour.

With briquets the furnace produced 70 lb. of iron per hour.

With powder (dust) the furnace produced 68 lb. of iron per hour.

The consumption of carbon was different in the three cases, being 660 lb. in the first and 726 lb. and 792 lb. per ton in the second and third cases. These differences are due to the hygroscopic nature of wood charcoal, the evaporation of the water requiring considerable heat. The differences are less if coke or anthracite is used instead of charcoal. In all cases it is possible to treat pulverised ores in this electric furnace, and even a mixture of hematite and retort coke in the powdered state, without difficulty. Comparative tests were made, smelting hematite, magnetite, and siderite with coke, charcoal, and anthracite. It does not make much difference which of the three forms of carbon is used. With charcoal the voltage tends to remain higher than with coke or anthracite, but this is not a serious defect. As regards thermal efficiency, anthracite gives the best result. Reductions of hematite with charcoal produced 68 lb. per hour, while anthracite gave 84 lb. per hour with the same electrical energy consumption. In the first case 792 lb. of carbon per ton of iron, and in the second case 596 lb. were used. Magnetite gives better returns than hematite with charcoal. Reduction of magnetite briquets produced 90 lb. per hour, whereas hematite gave only 70 lb. With anthracite both gave about the same result. The siderite was easily reduced, but with a large consumption of energy, yielding only 64 lb. per hour for the same energy consumption. Products obtained, when analysed, gave the following results:—

Carbon.	Manganese.	Silicon.	Sulphur.	Phosphorus.
0.08%	0.10%	0.02%	0.02%	traces
0.09%	0.09%	0.04%	0.02%	,,
0.11%	0.46%	0.06%	0.02%	,,

In the last, a large addition of ferromanganese ha

been made for comparison. These results were obtained by direct reduction from the ores. The iron is perfectly malleable, and can be hammered cold into thin sheets. After tempering, it bends at 180 deg. even with 0.20—0.25 per cent. carbon, which fact is due to its small percentage of manganese. It has great tenacity. As to the cost, it is stated that most of these tests were made with a 120-kW furnace. In the reduction of hematite with charcoal for the production of soft iron, the consumption was 3.430 kWh with a 120-kW furnace, and 2,600 kWh with a 200-kW furnace. Studies with regard to the influence of the forms of ores and carbon compounds used as charge on the amount of energy used for the production of one ton of soft steel gave the following results:—

Magnetite and charcoal	...	3.150 kWh.
Magnetite and anthracite	...	3.050 ,,
Hematite and charcoal	...	3.430 ,,
Hematite and anthracite	...	3.100 ,,
Siderite and anthracite	...	4.000 ,,

These tests were made in a 120-kW furnace. For a 200-kW furnace the efficiency is as high as 80 per cent.

As to the cost of maintenance, it is pointed out that the arc in this furnace is entirely enclosed by the charge, which absorbs all the heat of radiation, so that the heat losses are small. The wear and tear are small. During the entire time of the tests, the furnace used was not repaired, and was as good at the end of the operations as at the beginning. The amount of carbon in the charge varied with the different mixtures. Reduction of powdered hematite required 792 lb. of charcoal and 594 lb. of anthracite per ton of iron. Magnetite under the same conditions required only 682 lb. of charcoal and 572 lb. of anthracite. As a rule, 55-77 lb. of electrodes are consumed for the production of a ton of soft steel.

PLANT BREAKDOWNS.

(*Concluded from page* 156.)

During the overhaul of a 2,500-b.h.p. induction motor it was found that a red-fibre insulating or packing strip had worked out of the bottom of one of the rotor slots and was projecting 18 in. beyond the bed of the rotor. Examination showed that the packing strips in other slots were loose through shrinkage. When the repair came to be made difficulties were experienced in removing the rotor lengthways owing to the design of the machine. It was, therefore, found necessary to cut through the stator end turns in order that the top half of the stator might be removed and the rotor exposed for overhaul. A comparatively simple repair was thus rendered both difficult and costly, involving an unnecessarily long stoppage of important plant.

A 150-kW rotary converter was wrecked while being tested at the maker's works. A flash was noticed at the slip-ring end of the rotor and the breaker on the six-phase supply simultaneously came out. The machine continued to run off the d.c. supply. Owing to the field winding being compound wound, and the series field at full load being 50 per cent. of the shunt field, the machine at once ran up to excessive speed. The bedplate was severed in four parts, the armature core and windings, shunt field coils, commutator, brush-gear, one of the pedestal bearings, and sundry other parts were badly damaged, and the shaft was bent. The breakdown was due to a fault in the armature winding, but an overspeed device or a reverse-current circuit breaker on the d.c. side would have saved the machine.

Another case deals with the breakdown of an auto-transformer used for starting a 1,250-b.h.p. synchronous motor. This broke down within a few days of the machine's starting up; four coils were burned out and others distorted. The motor was driving an air compressor, and it seemed probable that the starting conditions had been of a more severe nature than originally anticipated, and in addition the coils had become loose through shrinkage. It appeared that the damage had been caused by the coils being violently repelled against the wood packing blocks separating the coils from the yokes. New coils were fitted and steel channel stiffeners put in hand. Whilst a fresh attempt at starting was being made, before the stiffeners could be fitted, a further breakdown took place necessitating the complete re-winding of one of the legs. The trouble was traced to the switchgear. There were two mechanically-interlocked switches for connecting the motor either to the transformer tapping or to the line. The interlocking arrangement had been incorrectly fitted, with the result that when changing-over was being effected both switches made circuit simultaneously and thereby short-circuited all the tapping windings of the auto-transformer.

A 210-kW compound wound, 12-pole generator driven by a gas engine had been in service for a considerable number of years. The insulation resistance gradually dropped, and eventually a breakdown occurred in the armature. It was found that the insulation had given way between the ends of the coils and the supporting ring at the back of the commutator. It was necessary to re-wind the armature. The report draws attention to the necessity of special insulation and good ventilation for machines working in close proximity to gas fumes.

In another case when the earth leakage trip of a 3,000-b.h.p. motor opened a circuit breaker, it was found that a piece of broken file had lodged in the air gap between the armature and field coils. This had damaged both the armature and the magnet core; the armature laminations had been damaged and forced into the windings. A large proportion of the winding had to be straightened out and re-insulated.

A similar case was that of a 45-h.p. slip-ring motor driving a stone crusher. A small piece of stone got into the machine between the rotor and stator, damaging the stator core teeth and earthing the windings. It was necessary to strip and completely re-wind the stator. Only one rotor coil was damaged, but this entailed a complete re-wind. If the openings in the end covers of the machine had been protected by expanded metal, this accident would not have occurred.

A 250-kW rotary converter developed an earth shortly after being put to work. The armature was taken out and tested and appeared satisfactory. As the fault could not be traced, the commutator was taken off to facilitate a more complete examination, but this was also found to be in order. The trouble was eventually located at one of the balancing weights at the slip-ring end. The block had become loose and had worn through the insulation of one of the equaliser connections; the equaliser connections had also been displaced. The fault was removed by re-insulating the block and connections, and securing the weight more firmly.

The breaking of a metal cutting saw, due to defective material, caused the 50-h.p. squirrel-cage motor, by which it was driven, to be torn from its foundations, all four feet being broken off. As the motor case was in two sections bolted together, it was possible to repair the motor by fitting a new bottom section and re-winding.

Numerous breakdowns of electrical machines arise from the core plates of either the stator or rotor being loose. This is due to either bad fitting or poor design, as exemplified in the two following cases:—

A 1,500-kW, six-phase rotary converter was proposed for insurance shortly after it had been put to work. One of the company's surveyors found that the armature core plates were loose on the spider, and acceptance was postponed until the matter was rectified. In the meantime, however, owing to the cutting of the insulation, the machine failed.

In a 525-kW compound-wound, 10-pole generator, driven by a steam engine, the core worked loose on the spider. The spider had six arms, and in each arm a key was fitted securing the core. The looseness caused some of the commutator connections to break off. Three new wedges and three channel keys were fitted alternately without dismantling.

The company's branch dealing with the insurance and inspection of boilers has continued to show a small but progressive rate of increase since the publication of the last report in 1910. The growing tendency to generate electricity in bulk and to distribute it over wide areas has the effect of supplanting small boilers by large ones, fewer in number and greater in output. Consequently extension in this department is to be found more through the inclusion of certain classes of pressure vessels than from orthodox steam boilers.

A number of cases of boiler failures which have come within the company's purview are stated in some detail and the causes explained. In some instances weak or faulty metal was to blame; graphite and electrolytic wastage was accountable in others. A very large part of the Insurance Company's report is devoted to abstracts of Board of Trade reports upon boiler and other steam vessel accidents during the years 1916-1921.

Electric Vehicle Batteries.—It is interesting to note that many of the new electric vehicles which are now being built by the various English manufacturers are being equipped with Exide-Ironclad batteries. Amongst them are the following:—Birmingham Corporation Cleansing Department, 12 batteries; 40 cells, 387 amp.-hour capacity. Leicester Corporation Cleansing Department, 8 batteries; 44 cells, 290/387 amp.-hour capacity. Hampstead Corporation Cleansing Department, 3 batteries; 44 cells, 290 amp.-hour capacity. Southend Corporation Cleansing Department, 4 batteries; 44 cells, 290 amp.-hour capacity. Liverpool Corporation, 2 batteries; 54 cells, 226 amp.-hour capacity.

All the above-named authorities have specified Exide-Ironclad batteries as a result of having used batteries of this type for periods varying from two to five years. The free service inspection which is carried out by the makers of this type of battery, whereby each battery in service is regularly inspected by a skilled man without cost to the battery user, is the only service of its kind in existence in this country.

AN ELECTRICALLY-PROPELLED BATH CHAIR.

Some little time ago at an exhibition interest was aroused in a bath-chair made by the Argson Engineering Co., Ltd., of Richmond, which employed electricity as motive power.

This has now successfully passed a series of tests extending over a period of 12 months, and it has been proved that the vehicle has a range of from 40 to 45 miles, according to the nature of the roads, and a speed of from seven to eight miles an hour.

The firm states that in designing the chair, the object was to suit the requirements of the user, and it endeavoured to produce a vehicle which was essentially an invalid chair rather than a modified and overloaded pedal cycle, or an undersized motor-car. A side view of the chair is given in fig. 1.

The small electric motor which propels the machine has been specially designed and constructed for this purpose. All parts are extremely strong; the shaft is of high-tensile nickel steel mounted on ball bearings, and the windings will carry enormous overloads without risk of damage. In spite of this liberal rating, the machine is extremely light and highly efficient, and it is largely on account of the exceptional character of the motor that such an extensive mileage on each battery charge can be obtained. The motor is totally enclosed in a highly-finished aluminium casing, which prevents all possible access of dirt or moisture to the interior.

The speed control is carried out by a patented method (Patent No. 32,215/22). The controlling switch is mounted on the steering tiller itself, and by an effortless twist of the stirrup handle the rider can cause the chair to proceed either forward or backward at graduated speeds, or bring into action a powerful electric brake. Thus the user may be assured of absolute safety in the most difficult places or on the steepest hills. A locking pin is provided for the controller, so that there is no risk of the machine being started accidentally.

The rear axle is a steel tubular weight-carrying structure which encloses the differential mechanism and the nickel steel shafts which transmit the power to the wheels. The motor is firmly secured to the axle, and an aluminium casing is provided to house and support the accurately-cut gears, which transmit the power from the motor shaft to the axle. All gears are of ample proportions and run in oil, and are mounted on ball bearings.

A band brake fitted with a ratchet mechanism can be actuated by a long lever conveniently disposed at the side of the chair. By the use of this brake, facility of mounting is ensured when the chair is standing on a steep incline.

The battery, like the remainder of the electrical equipment, has been specially constructed for this purpose. It consists of 12 cells of the D.P. Co.'s "Kathanode" type, with special wood and glass-wool separators, as regularly employed for

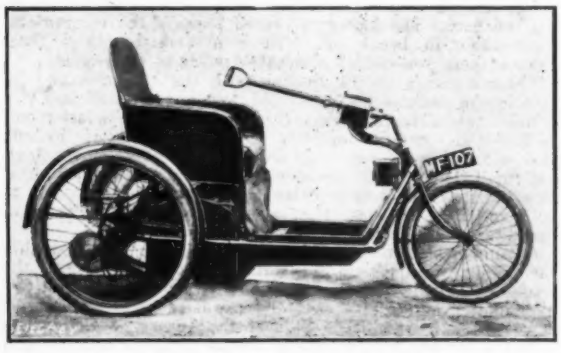

Fig. 1.—The Argson Electric Bath-Chair.

larger electric-vehicle propulsion. By undoing four connections the battery may be lifted out of the frame as a unit. The battery carries a special guarantee by its manufacturers covering a period of two years.

The frame is built up of weldless steel tubing, and its special design eliminates all curved tubes. Particularly noteworthy are the two straight tubes connecting the one-piece head casting to the main frame, which is amply cross-stayed and underslung on the back axle. This construction gives an exceedingly stiff frame and a low side to the foot box.

The seat is built up of weldless tubing, excellently upholstered, well padded with hair, and provided with a loose cushion to match. By supporting the rear end of the seat on a transverse leaf spring, and pivoting it at the forward end, a most resilient suspension is obtained, together with complete lateral stability. By releasing a thumb screw, the seat may be slung forward, giving access to the battery (see fig. 2).

The foot box, which is low to facilitate mounting, is stoutly constructed of deal sides and birch ply-wood bottom, and is finished with black varnish. The sloping foot rest and bottom are covered with rubber, and a large tool box is provided at the rear end.

Each chair is fitted with an ampere-hour meter, electric head and rear lamps, number plates, licence holder, bell, and apron. The tool box carries tire inflator, spanners, screwdriver, oil can, and sponge cloth. A receptacle for the charging plug is fitted to the battery, and the charging plug itself

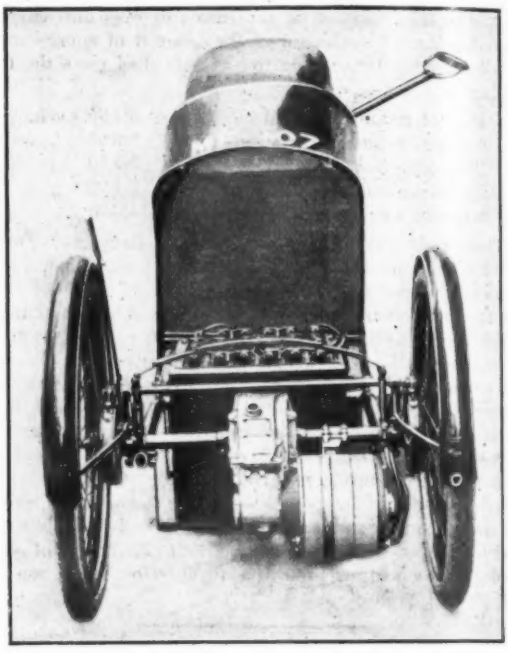

Fig. 2.—Seat Tilted for Inspection of Battery.

is provided in readiness for connection to the electricity supply.

The vehicle is given the best stove enamel and gold lining finish, and the bright parts are nickel plated or of polished aluminium.

The advantages claimed for the chair are that it is easy to enter and comfortable to ride in; can be controlled and steered with the utmost ease by the use of one hand only; will run a long distance (45 miles) without recharging; will climb the stiffest gradients with absolute certainty; and can be run at a nominal cost.

Electricity in the United States.—According to the United States Geological Survey, over one-third of the electricity produced in the year 1922 was generated by water power. The total production during the year was 47,659 million kWh, an increase of 16.3 per cent. upon the 1921 total, and of this 17,206 million kWh, or 36.1 per cent., was produced by water-power plant. As regarded steam generating stations, an improvement in efficiency was shown. The average consumption of coal, or its equivalent in other fuels, on a total production of 30,240 million kWh, was 2.5 lb., as compared with 2.7 lb. in 1921. In 1919 the figure was 3.2 lb. It is estimated that the saving of 20 million tons of coal was effected by the use of water power.

Fan Standardisation.—In common with other branches of engineering, the necessity for standardising the terms used in stating the performance or capacity of fans, and also a standard method of testing fans, has been apparent for some time—both to the users and to the makers. The Council of the Institution of Heating and Ventilating Engineers some time ago appointed a committee known as the Fan Standardisation Committee, representative of both fan manufacturers and users, together with representatives from the Admiralty and H.M. Office of Works. This committee has been holding meetings at regular intervals since the spring of last year. It finds that there are many difficult problems to settle, and that very considerable differences of opinion exist as to the correct terms to use and as to the best method of testing fans. It hopes, however, eventually to clear up all misunderstandings and ambiguities, and to issue a standard list of terms, and also to define a standard method of fan testing and a clear method of listing fan performances.

ELECTRO-CULTURE WORK IN 1922 AND 1923.

The Electro-Culture Committee of the Ministry of Agriculture (Chairman, Sir John Snell) has presented its fifth interim report. This is not available to the public, but a good abstract appeared in the July issue of the Ministry's *Journal*, and this is reproduced below :—

During 1922, field experiments were carried out for the Committee by Prof. V. H Blackman as follows :—*Rothamsted Experimental Station*—Experiments with winter wheat and barley; *Harper Adams Agricultural College*—Experiments with cabbages, swedes, mangolds and potatoes; *Lincluden*—An experiment with potatoes. An economic installation was erected at Rothamsted. Pot-culture experiments with barley were continued at Rothamsted. Laboratory investigations were conducted at the Imperial College of Science. Electrical measurements were made to determine the influence of an electro-culture installation on the electrical conditions to leeward and windward.

Field Experiments in 1922.—Seven experiments were carried out during the year, two with cereals, two with potatoes, two with root crops and one with cabbages; two of these gave a positive result and five a negative result. The season was not a favourable one for experimental purposes, the yields of the cereals being abnormally low, that of wheat being only about half the average. In the case of the root and cabbage crops, owing to the doubt which exists as to the satisfactory nature of the cultural conditions, the Committee is of opinion that no safe conclusions can be drawn from the experiments, and that the results should not be included in future records.

Pot-Culture Experiments of 1922.—Ten experiments were carried out with barley in 1922, and were mainly designed to obtain further knowledge as to the stage of plant growth during which the discharge could most advantageously be given, and the most suitable daily duration of the discharge. An experiment was also carried out to determine the effect of the normal atmospheric current. In all the experiments grain yields as well as total yields were obtained. The discharge was applied (in different experiments) in the first month, the second month, and the third month of the growing season respectively, and also throughout the whole three months; in the case of each period the discharge was applied (in different experiments) for six hours and also for one hour daily. Definite increases of yield were obtained in all the experiments but one, in which the plants were attacked by mildew. The increases in dry weight reached 39 per cent. in one experiment, but in other cases were quite small. In all cases, however, with the exception already mentioned, very marked increases in *grain* yield were obtained, reaching even 118 per cent., and these large increases in grain yield were usually associated with very small increases in total yield. The effect is so marked that it establishes a differential action of the discharge—that of accelerating reproductive growth apart from vegetative growth, an effect hitherto unsuspected. Another striking result was the marked effect on grain yields of comparatively short periods of discharge. Electrification for the first, second and third month, respectively, of the growing season gave in all cases large increases of grain, the second monthly period being the highest of the series with a yield more than double that of plants not subjected to the discharge. How far such a large increase may be expected in other seasons remains to be determined. In one experiment plants were subjected to a discharge of a lower intensity than any hitherto employed, the current being only about 100 times the value of the normal atmospheric current. This current, which was continued for the full period, was apparently as effective as the stronger current, except in the case of plants electrified for the second month. The removal of plants from the influence of the normal atmospheric current was accompanied by a slight reduction in yield.

Economic Installation at Rothamsted.—A field installation was erected on Foster's Field at Rothamsted in 1922 on an economic scale (*i.e.*, with poles spaced widely, and with high wires, so that no undue interference was caused to farming operations), the object being to determine the kind of installation suitable for the purpose, the current required, and the cost. The area under the influence of this installation (assuming the discharge to be effective for 15 ft. beyond the wires on all four sides) is about 5 acres. The installation consists of nine creosoted poles each 24 ft. in length, of which 6 ft. is sunk in the ground; four of the poles are in the field and five in the hedges. The supporting wires at the ends of the area and in the middle of the area are of rustless mild steel (No. 12) each 125/150 yards long. There are 12 thinner wires (No. 26) of silicium bronze, each 200 yards long. The porcelain rod insulators are 18 in. long. The cost of the installation and its erection (materials, carriage, labour, travelling expenses and supervision) was £52, or about £10 per acre.

The Agricultural Electric Discharge Co. has supplied the Committee with estimates of the cost of erection of an economic installation in areas of various sizes. The cost of the poles, insulators, and wires for 100 acres is £215, *i.e.*, slightly over £2 per acre, so that it is obvious that the price for small installations is no criterion of the cost in actual practice. The fact that fields are not of the size of 100 acres hardly affects the question since several fields can be included in one installation.

Electrical Measurements, 1922.—The measurements were taken at Rothamsted (1) on the wheat plot, (2) on the stubble after the wheat crop was removed, and (3) on the field under the economic installation.

Before these experiments doubt might well have been entertained whether even a rough estimate of the current passing to the crop could be derived from the measurements of the current passed into the overhead wires. It now seems fairly certain, however, that with overhead wires whose distance apart is not much in excess of their height, fully half the current supplied to the wires may be expected to reach the crop. It is also clear that a very considerable area surrounding the electro-culture area, especially on its leeward side, receives a discharge much in excess of that which passes normally between air and earth.

The Committee's Work in 1923.—The results obtained in 1922 indicated the importance of concentrating attention on pot-culture experiments, small plot experiments, and laboratory work. The experiments of 1922 on the effect of the discharge during different growing periods and different daily periods are being repeated in 1923; the effect of very weak currents and the effect of screening the plants from the normal atmospheric current are again being studied. The results obtained from pot experiments are not always reproduced in the field owing to the effect of subsoil and other factors. Small plot experiments are, therefore, being carried out at Rothamsted and Lincluden for comparison with the results of the pot-culture experiments; the discharge is being applied for three different periods :—one, two, and three months respectively.

The economic installation at Rothamsted is being used for crop electrification, and measurements will also be made of the electrical conditions in and under that installation. It has been found that the effect of the current is greater a short time after the application of the discharge has ceased than during the period of the discharge. Laboratory experiments are therefore being carried out to ascertain the minimum period of electrical stimulation giving the greatest after effect as exhibited by an increase in the rate of growth. Work on a field scale is being suspended during 1923, except for small plot work and the collection of data from the economic installation.

The results obtained from pot-culture work in 1922 are important, *inter alia*, from the point of view of the installation required on an economic scale. If it were necessary to apply the discharge for one month only, a very temporary installation could possibly be used, with consequent reduction in cost. Different fields could possibly be treated with the same installation. With lower heights of wires a lower voltage would suffice, and it might even be possible to apply the discharge by means of apparatus comparable to a "Knapsack Sprayer," or some ordinary agricultural implement. The Committee is keeping this aspect of the question in view.

Future Work of the Committee.—It is clear that the electro-culture problem is an intricate one, with both physiological and agricultural aspects, and one which is far from being fully elucidated. The Committee's investigations, however, may be fraught with the most important consequences to agriculture as the results hitherto attained clearly indicate.

By a series of field experiments spread over a number of years the Committee has shown the type of electrical apparatus most suitable for the production of the high-pressure discharge, and has also shown that an increase of 20 per cent. can be obtained with certain cereal crops. That such results should have been obtained is very striking when the poverty of our knowledge of the conditions under which the electric discharge should be applied is taken into consideration. The Committee holds that a study, by laboratory and pot-culture methods, of the effect of the discharge at different stages of the plant's growth, of the effect of different daily periods of discharge, and of different strengths of current, will throw much light on the proper conditions under which the discharge should be given in the field. The Committee is confirmed in the view by the remarkable results obtained in 1922 when in pot-culture experiments an increase of 118 per cent. was obtained with only a single month's electrification.

Such results as these are of very great promise, for if smaller increases of 40 or 50 per cent. can be obtained in the field there can be no question of the economic application of electro-culture. The Committee therefore proposes in the year 1924 as in 1923 to confine the work to pot-culture and small plot experiments, and to laboratory investigations. It is proposed, however, that in 1925 field experiments shall again be undertaken on the basis of the scientific knowledge acquired in the previous years. The Committee expects by the end of 1925 to have made very definite progress in knowledge of electro-culture, and a definite advance towards its practical application.

THE "ARCA" REGULATOR.

An automatic regulating device of Swedish origin, known as the "Arca," possesses many features of novelty and utility. It can be employed for many purposes, as it is influenced by changes of pressure, temperature, humidity, and electrically by variations in current and voltage. In all its applications the main principles are the same, and fig. 1, which is a diagrammatic representation of the regulator as applied to the control of steam pressure, is typical.

In this case, an ordinary double-beat valve is used, the hand-wheel being replaced by a sprocket wheel. A chain passes over this wheel, supporting on one end a counterweight, and is connected at the other end to the piston of the "Arca" pressure cylinder. The pressure cylinder is connected by a single pipe to the relay control, which is mounted on a wall panel carrying a pressure gauge. An enlarged view of the relay is shown in section.

The relay contains a diaphragm-operated pilot valve (A). Port (B) of this valve is connected with the cylinder as shown, port (C) with the main water supply, and port (D) is the exhaust connection to the drain. The water entering at (C) passes through the centre of the pilot valve (A) past the pin (E), into the diaphragm chamber (F). One side of this chamber is formed by a diaphragm (G). The water causes a certain pressure to act on the diaphragm (G), which is normally counteracted by a spring on the other side. If the water pressure on the diaphragm changes, it is clear that the pilot valve will move either in or out, thus connecting port (B) with either ports (C) or (D).

To make the water pressure on the diaphragm independent of changes in the pressure of the supply water, the flow of water through the centre of pilot valve (A) into the chamber (F) is restricted by the pin (E). From the chamber (F) there is a passage (H) through which the water can flow, and if the discharge from (H) is suppressed in the slightest degree,

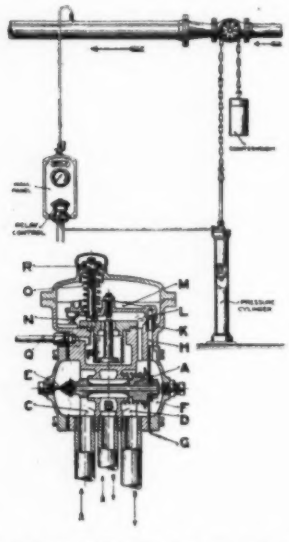

Fig. 1.—The "Arca" Regulator as applied to Steam-Pressure Control.

it will cause an immediate increase in the water pressure on the diaphragm. This is the essence of the "Arca" principle.

At the upper end of passage (H) is a small jet (K). Covering this jet is a disk (L) attached to one end of a pivoted lever (M). This lever rests on pivoted points (N), and is held towards the jet by an adjustable spring (O). Acting in opposition to the spring is a metal bellows (P), influenced by the controlled pressure entering by the pipe (Q).

The action of the regulator is as follows:—If the controlled pressure rises slightly the bellows (P) contracts and pushes the lever (M) away from the jet (K), with the result that more water can flow through the jet, and the pressure in the chamber (F) falls. Diaphragm (G), and with it pilot valve (A), moves to the right; port (D) is put into communication with port (B), *i.e.*, the pressure cylinder is connected with the drain pipe. The counterweight then draws the piston out from the hydraulic cylinder, checking down the double-beat valve. This movement continues until the correct opening of the valve to suit the demand is obtained. The adjusting screw (R) operating on spring (O) is provided for the setting of the relay to suit any desired pressure within the limits for which the relay is constructed. If the controlled pressure drops, the bellows (P) expands, and spring (O) forces the lever closer to the jet (K) suppressing the flower of water, and, in consequence, building up pressure in chamber (F). The diaphragm, and with it the valve, therefore move to the left; port (C) is connected with port (B), and water is admitted to the hydraulic cylinder, forcing the piston down, and thus opening up the double-beat valve.

The sensitiveness of the system will be understood from the fact that a movement of half a thousandth of an inch on the end of the lever (M) is sufficient to change the pressure in chamber (F), thereby moving the pilot valve (B), so that the piston of the hydraulic cylinder functions in the desired direction. This extreme sensitiveness is obtained without the use of complicated or delicate parts which can be easily damaged or put out of order.

For electrical regulation the lever (M) is extended from the relay at right angles (making it a bent lever), as shown in fig. 2, and it is connected to a hinged plate upon which are mounted two solenoids. The cores of these are adjacent to a fixed metal bar at the base of the panel, and their movement (and through them the movement of the hinged plate) is caused by any increase or decrease in the strength of the current, and the movement is transmitted (and magnified) by the relay, *via* the pressure cylinder, to a rheostat control.

The regulator has also been applied to the control of fur-

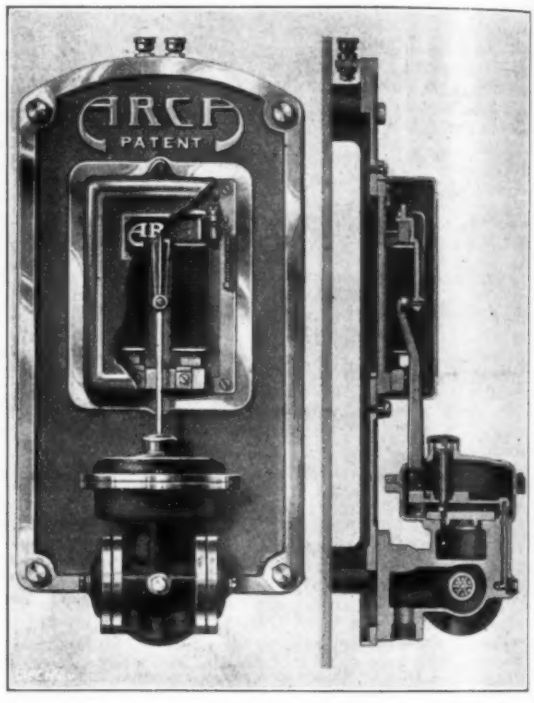

Fig. 2.—The "Arca" as a Current or Voltage Regulator.

nace electrodes at the Vasteras works of the Allmanna Svenska Elektriska Aktiebolaget. Other applications include humidity regulation in textile and other factories; fluid level regulation for tanks, boilers, &c.; gas pressure and vacuum regulating; speed governing, &c.

The device is being exploited in this country by British Arca Regulators, Ltd., Windsor House, Victoria Street, S.W.1. At this address many of the purposes for which the regulator can be used are demonstrated.

EAST GRINSTEAD ELECTRICITY WORKS.

The question of an electricity supply for East Grinstead was first mooted in 1894, but although the matter was raised on subsequent occasions it was not until 1915 that a Provisional Order was obtained by the Urban District Council. The commencement of a scheme was delayed by the war, but eventually a start was made in January, 1922, when tenders for plant were invited by the Council, and a canvass of the residents made. A scheme drawn up by Mr. J. B. Morgan, A.M.I.E.E., provided for an expenditure of £21,000, and this was commenced rather less than a year ago, and inaugurated on July 16th. The plant is housed in what was originally a brewery situated on the main London Road in a central position. The engine room is 80 ft. long and 27 ft. wide, with glazed brick walls, and parallel to it is a battery room 66 ft. long and 22 ft. wide. A well lighted workshop adjoins the engine room, and there is ample accommodation for offices and stores. The chimney is utilised for the final exhaust from the silencers, and the old Cornish boilers have been adapted for fuel oil tanks, having a combined storage of some 14 tons.

The generating plant consists of two Vickers-Petters semi-Diesel engines of 120-b.h.p., direct-coupled to Crompton d.c. generators, having an output of 80 kW at 500 V. There is

also a balancer-booster of Crompton & Co.'s make, capable of dealing with 100 A on the middle wire, and an output of 120 A at 140 V on each booster.

The circulating water for the engines is taken from an 11,000-gal. cast-iron tank, situated some 35 ft. above engine room floor level, flowing to the engines by gravity, and is returned to the tanks by centrifugal pumps. The storage battery consists of 260 cells of 250 Ah capacity, at the three-hour rate, and was supplied by the Pritchett & Gold and E.P.S. Co., Ltd., Messrs. Crompton & Co., Ltd., being the main contractors. The glass boxes are large enough to allow for 50 per cent. increased capacity when the need for battery extension arises.

The main switchboard was supplied by the Park Royal Engineering Works, Ltd., and contains the usual gear for three-wire working, as well as the separate feeder switchgear for street lighting control.

A 3-ton hand traveller crane was supplied by Messrs Holt and Willetts, Cradley Heath.

Messrs. G. E. Taylor, of Suffolk Lane, E.C., were the contractors for the mains system and street lighting. The cables are paper-insulated, lead-covered and armoured, laid direct in the ground with a heavy oak board protection. Concentric cable has been installed for feeders, and 3-core for distributors. The cables were made by the Enfield Ediswan Cable Co., Ltd. The street lighting is on a completely separate system of feeders and mains. Two feeders both for private and public lighting have been provided, and approximately five miles of cables has been laid. Underground joint boxes have been reduced to a minimum, the network being well supplied with section pillars. The street lighting consists of 50 posts fitted with swan-neck brackets, with one 60-watt gasfilled lamp per post, for ordinary positions, and two lamps per post on important corners. The feeder and section pillars, lamp-posts, and fittings were supplied by Messrs. Lucy & Co., Oxford.

IMPORT TRADE OF SIAM.

The following figures, showing the imports of electrical and similar goods into the port of Bangkok during the year ended March, 1922, are taken from the recently-issued official trade statistics; the figures for the year ended March, 1921, are included for purposes of comparison, and notes of any increases or decreases are given. Imports stated to be from Singapore and Hong-Kong are for the most part the products of other countries shipped *viâ* these two ports:—

	1920-21. Ticals.	1921-22. Ticals.	Inc. or dec. Ticals.
Lamps.—			
Total	316,000	213,000	− 103,000
From Singapore ...	9,000	56,000	+ 47,000
„ Hong-Kong ...	3,000	11,000	+ 8,000
„ United Kingdom	53,000	22,000	− 31,000
„ United States ...	114,000	72,000	− 42,000
„ Japan	45,000	46,000	+ 1,000
„ Germany ...	58,000	3,000	− 55,000
Electrical goods and apparatus.—			
Total	1,080,000	1,325,000	+ 245,000
From United Kingdom	293,000	472,000	+ 179,000
„ Germany ...	7,000	37,000	+ 30,000
„ United States ...	328,000	350,000	+ 22,000
„ Singapore ...	26,000	26,000	—
„ Sweden	25,000	237,000	+ 212,000
„ Italy	20,000	5,000	− 15,000
„ Holland	28,000	31,000	+ 3,000
„ France	16,000	13,000	− 3,000
„ Japan	269,000	102,000	− 167,000
Manufactures of Copper.—			
Total	40,000	42,000	+ 2,000
From Hong-Kong ...	1,000	3,000	+ 2,000
„ United Kingdom	32,000	25,000	− 7,000
„ India	2,000	5,000	+ 3,000
Scientific instruments and apparatus.—			
Total	290,000	292,000	+ 2,000
From United Kingdom	148,000	116,000	− 32,000
„ Germany ...	8,000	6,000	− 2,000
„ France	10,000	31,000	+ 21,000
„ Japan	31,000	31,000	—
„ United States ...	58,000	56,000	− 2,000
Prime movers, other than locomotives, marine, milling, and agricultural machinery.—			
Total	562,000	558,000	− 4,000
From United Kingdom	319,000	450,000	+ 131,000
„ United States ...	142,000	42,000	− 100,000
Machine Tools.—			
Total	156,000	193,000	+ 37,000
From United Kingdom	143,000	146,000	+ 3,000
„ United States ...	4,000	30,000	+ 26,000
Machinery unenumerated, including detached parts, and not including agricultural, textile, or sewing machines.—			
Total	1,037,000	1,028,000	− 9,000
From United Kingdom	663,000	733,000	+ 70,000
„ Japan	36,000	5,000	− 31,000
„ United States ...	158,000	99,000	− 59,000
„ France	27,000	51,000	+ 24,000
Iron and steel wire and manufactures thereof.—			
Total	281,000	97,000	− 184,000
From United Kingdom	182,000	40,000	− 142,000
„ Germany ...	11,000	22,000	+ 11,000
„ United States ...	31,000	6,000	− 25,000
Railway material.—			
Total	2,193,000	4,143,000	+1,950,000
From United Kingdom	378,000	1,311,000	+ 933,000
„ United States ...	1,724,000	2,791,000	+1,067,000
Cars or trucks for railways or tramways.—			
Total	1,656,000	469,000	−1,187,000
From United Kingdom	1,596,000	463,000	−1,133,000
„ United States ...	27,000	2,000	− 25,000
Caoutchouc manufactures, other than tires.—			
Total	175,000	157,000	− 18,000
From Singapore ...	92,000	106,000	+ 14,000
„ United Kingdom	47,000	33,000	− 14,000
„ United States ...	14,000	3,000	− 11,000
„ Japan	7,000	7,000	—

Note.—£1 = about 13 Ticals.

NEW PATENTS APPLIED FOR, 1923.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens, Patent Agents, 285, High Holborn, London, W.C. 1.

18,036. "Combined switch and plug." J. C. Adams. July 12th.
18,045. "Regenerative circuits for wireless apparatus, &c." L. H. Paddle. July 12th.
18,062. "Dynamo-electric machines." J. A. Smith. July 12th. (United States, July 28th, 1922.)
18,066. "Electric incandescent lamps, thermionic valves, &c." N. Wise. July 12th.
18,069. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., and C. Gillings. July 12th.
18,077. "Television apparatus." R. H. Martin and F. M. Robb. July 12th.
18,089. "Head telephone receivers." F. R. Griffiths and Sterling Telephone & Electric Co., Ltd. July 12th.
18,100. "Reception of electric signals." Eastern Telegraph Co., Ltd., H. V. Higgitt, and W. C. Hubble. July 12th.
18,115. "Movable coil boxes for electric cables." Felten & Guilleaume Carlswerk Akt. Ges. July 12th. (Germany, July 12th, 1922.)
18,122. "Wireless receivers." G. B. Burnside. July 13th.
18,124. "Electric lanterns." P. J. Robinson and Smith & Ansell, Ltd. July 13th.
18,140. "Electric switches." W. H. Gardner. July 13th.
18,147. "Electric cranes." P. D. Ionides and Ransomes & Rapier, Ltd. July 13th.
18,194. "Feeding reactance coils having ferro-magnetic circuits." M. Latour. July 13th. (France, July 13th, 1922.)
18,195. "Variometer." H. G. W. Larcher. July 14th.
18,199. "Lift, &c., arrester." E. V. Davies, G. Smith, and F. Whittle. July 14th.
18,219. "Joint for electrical conductors." H. W. Lundin. July 14th.
18,230. "Coil holder for wireless purposes." J. H. Hall, S. E. Hall, and H. H. Ratcliff. July 14th.
18,242. "Sparking plugs." K. E. L. Guinness. July 14th.
18,248. "Electromagnetic mechanisms." Automatic Telephone Manufacturing Co., Ltd., and A. E. Hudd. July 14th.
18,251. "Electric-conduit fittings." F. Firth. July 14th.
18,257. "Wireless telephony." R. L. Beaumont and T. E. Beaumont. July 14th.
18,275. "Clip for holding crystals for wireless reception." S. Edem-Green. July 16th.
18,278. "Receiving device for electric telephone." G. N. Ewing and V. Lloyd. July 16th.
18,292. "Telephone receivers." Abbey Industries, Ltd., H. M. Melville-Smith and S. J. Tyrrell. July 16th.
18,293. "Telephone receivers." Abbey Industries, Ltd., H. M. Melville-Smith and S. J. Tyrrell. July 16th.
18,294. "Telephone headpieces." Abbey Industries, Ltd., H. M. Melville-Smith and S. J. Tyrrell. July 16th.
18,302. "Sparking-plugs." T. E. Rofe and S. Le F. Varvel. July 16th.
18,316. "Electric multiplex-communication." J. Oguti. July 16th. (Japan, August 17th, 1922.)
18,320. "Crystal receiver sets, and cabinets therefor." F. Edwards. July 16th.
18,324. "Production of sonorous vibrations." M. L. Severy. July 16th.
18,330. "Electro-magnets." E. B. Thurston. July 16th.
18,332. "Vacuum electric tubes." E. Y. Robinson. July 16th.
18,339. "Electric coils." C. F. Elwell, Ltd., and B. E. G. Mittell. July 16th.
18,341. "Electric terminal connections for wireless apparatus." F. C. B. Chase. July 16th.
18,342. "Electric light fittings." F. C. B. Chase. July 16th.
18,348. "Heating units for electric heaters, &c." A. Nielson. July 16th.
18,352. "Relay devices for automatic telephone systems." H. E. Humphries and Siemens Bros. & Co., Ltd. July 16th.
18,353. "Telephone systems." H. E. Humphries and Siemens Bros. and Co., Ltd. July 16th.
18,355. "Apparatus for drying and impregnating insulated electric cables." H. J. Pooley and G. Scott & Son (London), Ltd. July 16th.
18,359. "Electrodes for electrolytic cells." Electro Chemical Co. July 16th. (United States, July 15th, 1922.)
18,371. "Semi-automatic electric sub-stations." B. Thomas. July 17th.
18,372. "Electric fuses." L. B. Allan and E. Wilcox. July 17th.

18,380. "Crystal detectors." R. V. Willesford. July 17th.
18,383. "Receiving-device for telephony." O. Stokes. July 17th.
18,390. "Sparking plug." A. T. Johnson and S. G. Ransley. July 17th.
18,406. "Coil-holders for wireless tuning coils." Fuller"s United Electric Works, Ltd., and A. P. Welch. July 17th.
18,409. "Wireless receiving set." M. L. Bowdin. July 17th.
18,410. "Electric switches for electric meters, &c." R. Hornby and A. H. Jacks. July 17th.
18,419. "Amplifiers." P. G. A. H. Voigt. July 17th.
18,423. "Electric altar-bread baking device." J. Meany. July 17th.
18,424. "Thermionic valves." W. R. Bullimore. July 17th.
18,425. "Thermionic valves." W. R. Bullimore. July 17th.
18,427. "Levelling-means for lifts, &c." Waygood-Otis, Ltd. (Otis Elevator Co.). July 17th.
18,433. "Terminals for electric current conductors." E. F. Fleet, F. Horler and Westinghouse Brake & Saxby Signal Co., Ltd. July 17th.
18,448. "Heat control for electric furnaces." W. Elsdon-Dew, L. Pryce, and L. B. Woodworth. July 17th. (United States, January 13th.)
18,466. "Telephone systems." Compagnie Générale de Télégraphie sans Fil. July 17th. (France, May 5th.)
18,468. "Thermionic discharge tubes." British Thomson-Houston Co., Ltd. (General Electric Co.). July 17th.
18,471. "Miners', &c., electric lamps." G. H. Darby, J. Oldham and Oldham & Son, Ltd. July 17th.
18,479. "Electrical apparatus." Measurement, Ltd. July 17th. (France, July 17th, 1922.)
18,480. "Electrical apparatus." Measurement Ltd., July 17th. (France, July 17th, 1922.)
18,482. "Means for inserting conductors of submarine cable into junction sleeve." Felten & Guilleaume Carlswerk Akt. Ges. July 17th. (Germany, July 17th, 1922.)
18,483. "Apparatus for controlling motor compressors on electric vehicles." Akt. Ges. Brown, Boveri et Cie. July 17th. (Germany, July 20th, 1922.)
18,492. "Electric power transmission systems." A. M. Taylor. July 18th.
18,493. "Switches for transmission of wireless telegraph signals, &c." H. A. Madge. July 18th.
18,500. "Receiver for telephonic, &c., signals." L. H. Mansell. July 18th.
18,512. "Thermionic valves, &c." H. J. Osborn and W. L. Turner. July 18th.
18,519. "Method of adding capacities to telephone circuits." Western Electric Co., Ltd. (Western Electric Co., Inc.). July 18th.
18,527. "Electric control devices." Radio Engineering Co., Ltd., and P. B. Snoaden. July 18th.
18,528. "Electric control devices." Radio Engineering Co., Ltd., and P. B. Snoaden. July 18th.
18,529. "Induction-coil holders." Radio Engineering Co., Ltd., and P. B. Snoaden. July 18th.
18,538. "Electrical strain insulators." H. J. Wiseman. July 18th.
18,550. "Electric lighting apparatus for motor-cars." G. Unterberg. July 18th.
18,557. "Braking systems for motor-driven machinery operating on alternating current." Igranic Electric Co., Ltd. (Cutler-Hammer Manufacturing Co.). July 18th.
18,558. "Omnibuses, tramcars, &c." H. Tasman-Davies. July 18th.
18,564. "Crystal detectors for wireless reception." C. W. Crouchley. July 18th.
18,565. "Acoustic apparatus." H. Baron (Signal Ges.). July 18th.
18,567. "Variable electric condensers." Marrec, Ltd., and Y. Marrec. July 18th.
18,580. "Electrodes." British Thomson-Houston Co., Ltd. July 18th. (United States, August 3rd, 1922.)
18,589. "Tuning device for radio telegraphy, &c." H. R. Morgan. July 18th.
18,602. "Crystal detectors." R. L. O'Sullivan. July 19th.
18,615. "Telephone systems." Western Electric Co., Ltd. July 19th. (United States, July 26th, 1922.)
18,632. "Telephone receivers." A. Orling. July 19th.
18,642. "Telegraphy, &c." Compagnie pour la Fabrication des Compteurs et Matériel d'Usines à Gaz. July 19th. (France, July 20th, 1922.)
18,645. "High-tension batteries for wireless apparatus." Efandem Co., Ltd., and A. Hooper. July 19th.
18,649. "Automatic electric substation control equipments." British Thomson-Houston Co., Ltd. July 19th. (United States, September 15th, 1922.)
18,665. "Fluorescent screens for X-rays." R. Jahoda and L. Lilienfeld. July 19th. (Austria, July 29th, 1922.)
18,687. "Terminals for electric conductors." J. S. A. Walsh. July 20th.
18,702. "Apparatus for reception of wireless signals." Economic Car Light, Ltd., and W. W. Lewis. July 20th.
18,703. "Control apparatus for electrical machines." G. Austin and G. Austin, Ltd. July 20th.
18,708. "Radio broadcasting systems." Western Electric Co., Ltd. July 20th. (United States, August 14th, 1922.)
18,709. "Control systems for dynamo-electric machines." Metropolitan-Vickers Electrical Co., Ltd. July 20th. (United States, July 20th, 1922.)
18,711. "Control systems for dynamo-electric machines." Metropolitan-Vickers Electrical Co., Ltd. (Westinghouse Electric & Manufacturing Co.). July 20th.
18,712. "Apparatus for generation of electricity." O. F. Dupont and A. Hewer. July 20th.
18,714. "Wireless crystal detector." J. Isitt and C. H. Vince. July 20th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1922.

3,333. "Methods of, and apparatus for determining distances by means of reflected sound waves." H. Baron (Signal Ges.). February 4th, 1922. (200,123.)
3,593. "Method for effecting an automatic continuous operation of copying telegraphs." M. H. Petersen. February 17th, 1921. (175,617.)
3,673. "Automatic regulator for electric, steam, or hot-water radiators, the same being applicable for gas-heating, fire-alarm devices, refrigerating-control and other temperature-control uses." R. Maclaren. June 20th, 1922. (Patent of addition not granted.) (200,124.)
6,120. "Electrode holders for high-frequency electrical apparatus." J. B. Bower. March 1st, 1922. (200,131.)
6,122. "Electrical interrupters or make-and-break switches with vibratory contacts." J. Bower. March 1st, 1922. (200,132.)
6,575. "Manufacture of electrical conductors." R. B. Ransford (W. S. Smith). March 6th, 1922. (200,144.)
7,121. "Ventilating or cooling electrical machines." K. Baumann and Metropolitan-Vickers Electrical Co., Ltd. March 10th, 1922. (200,149.)
9,786. "Safety devices for switch hooks of telephone instruments." Compagnie Française pour l'Exploitation des Procédés Thomson-Houston. April 8th, 1921. (178,117.)
9,911. "Means for, and methods of reducing self-induction and eddy-current losses in underground electric cables." A. M. Taylor. April 7th, 1922. (200,194.)
10,088. "Telephone systems." H. S. Conrad. April 8th, 1922. (200,206.)
10,089. "Apparatus for use in automatic telephone or like systems." H. S. Conrad. April 8th, 1922. (200,207.)
10,090. "Switching or like mechanism for use in telephone or like systems." H. S. Conrad. April 8th, 1922. (200,208.)
10,091. "Switching mechanism." H. S. Conrad. April 8th, 1922. (200,209.)
10,092. "Telephone systems." H. S. Conrad. April 8th, 1922. (200,210.)
10,093. "Telephone systems." H. S. Conrad. April 8th, 1922. (200,211.)
10,094. "Telephone systems." H. S. Conrad. April 8th, 1922. (200,212.)
10,155. "Fishplates for railway and tramway rails and methods of making rail joints." O. R. Williams. April 10th, 1922. (200,216.)
10,214. "Automatic and semi-automatic telephone systems." Relay Automatic Telephone Co., Ltd., and B. B. Johnson. April 10th, 1922. (200,217.)
10,393. "Regulators for electron-discharge devices." British Thomson-Houston Co., Ltd. (General Electric Co.). April 11th, 1922. (200,224.)
10,548. "Electric furnaces." Dr. A. Heltenstein. April 12th, 1921. (178,454.)
10,656. "Electric distributing systems." M. Togani. April 13th, 1922. (200,233.)
10,791. "Electric fuses." J. A. Crabtree. April 18th, 1922. (200,227.)
11,483. "Electrical stop motions for knitting machines." O. Y. Imray. Hineline Engineering Co.). April 24th, 1922. (200,250.)
11,601. "Means for reducing the distortion in a telephone or like repeating system." Western Electric Co., Ltd. (Western Electric Co., Inc.). April 25th, 1922. (200,254.)
11,617. "Electric safety lamps for preventing explosions in the presence of explosive gases." V. Pawelecki. April 25th, 1922. (200,255.)
11,975. "Railway signalling systems." Automatic Telephone Manufacturing Co., Ltd., and A. E. Hudd. April 28th, 1922. (Patent of addition not granted.). (Cognate application 5,816/23.) (200,267.)
12,013. "Manufacture of cores for mercurial cut-outs." W. H. Illingworth. April 29th, 1922. (Cognate application 35,462/22.) (200,268.)
12,431. "Time-indicating device for use with telephones." R. B. Clamp. May 3rd, 1922. (200,274.)
12,959. "Setting arrangements for selectors in automatic or semi-automatic telephone systems." C. A. W. Hultman. May 28th, 1921. (180,904.)
13,079. "Controllers for electrical apparatus." B. A. G. Churcher, R. Brooks, and Metropolitan-Vickers Electrical Co., Ltd. May 9th, 1922. (200,285.)
13,450. "Convertible and multiple electric junction plugs." P. Arnoux. May 12th, 1921. (179,955.)
13,601. "Primary cells." V. E. Richards. May 15th, 1922. (200,299.)
14,050. "Operating gear for electrical switches, controllers, and other like apparatus." H. Fawcett and Metropolitan-Vickers Electrical Co., Ltd. May 18th, 1922. (200,295.)
14,210. "Connecting and supporting device for electric fixtures." Benjamin Electric, Ltd. May 20th, 1921. (180,339.)
15,324. "Trolley-pole supports for electric traction." A. C. van Hoogdonk. May 31st, 1922. (200,316.)
15,329. "Solenoids." C. Ter Cock. May 31st, 1922. (200,317.)
17,596. "Systems of electro-mechanical control." Soc. Des Etablissements Gaumont. July 22nd, 1921. (183,437.)
17,651. "Electric motors." T. Yamamoto and M. Kawarada. July 4th, 1921. (Addition to 172,603.) (182,466.)
17,915. "Electric clock." C. P. Williams. June 29th, 1922. (200,347.)
18,249. "Head lights." Naamlooze Vennootschap Philips' Gloeilampenfabrieken, D. Lely, Junr., and H. F. Jacoon. July 3rd, 1922. (200,351.)
18,321. "Uni-directional electric current-carrying devices." Westinghouse Brake and Saxby Signal Co., Ltd., March 7th, 1922. (194,653.)
18,337. "Illuminated advertising devices." A. Wuillemin. July 4th, 1921. (182,794.)
19,142. "Casings for liquid-cooled electrical apparatus, such as transformers." British Thomson-Houston Co., Ltd. (General Electric Co.). July 12th, 1922. (200,362.)
19,144. "Electrical induction apparatus, such as transformers." British Thomson-Houston Co., Ltd. (General Electric Co.). July 12th, 1922. (200,363.)
19,448. "Junction outlet or like boxes used in electric wiring systems." W. Osborne. July 15th, 1922. (200,373.)
19,617. "Apparatus for the electrolysis of water." L. Casale. July 19th, 1922. (200,376.)
19,828. "Joints of railway, tramway, and like rails." S. Butler. July 19th, 1922. (200,377.)
19,956. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. September 10th, 1921. (186,037.)
20,062. "Automatic regulation of the output of an electric installation." M. Doloukhanoff. July 21st, 1922. (200,382.)
20,336. "High-frequency signalling systems." British Thomson-Houston Co., Ltd. April 18th, 1922. (196,561.)
20,461. "Electric arc welding apparatus." British Thomson-Houston Co., Ltd. July 26th, 1921. (183,834.)
22,082. "Electric couplings." C. Mendler. August 14th, 1922. (200,391.)
22,481. "Electric lighting and starting machines for motor vehicles." R. Bosch Akt. Ges. September 19th, 1921. (186,318.)
22,648. "Combined gas and electric cooking apparatus." E. C. R. Marks (Salvisberg Fabrik Elektrischer Koch-und Heizapparate "Salvis," E.) August 19th, 1922. (200,394.)
24,926. "Electrolytic manufacture of lead alloys." W. Mathelius. September 14th, 1922. (200,408.)
25,063. "Apparatus for regulating electric generators running at various speeds." J. Thum. October 22nd, 1921. (187,949.)
25,476. "High-tension coils composed of round-section wire." Akt. Ges. Brown, Boveri et Cie. September 11th, 1921. (187,211.)
25,915. "Electric heaters." British Thomson-Houston Co., Ltd. (International General Electric Co., Inc.). September 25th, 1922. (200,414.)
26,921. "Electric controllers." J. Munn. October 5th, 1922. (200,418.)
27,097. "Multiple armature relay." F. Aldendorff. October 19th, 1921. (187,593.)
28,242. "Apparatus for the electrolysis of metals." A. Cremer. October 18th, 1921. (187,607.)
28,935. "Non-spillable boxes or containers, such as those used for electric accumulators or the like." W. R. Edwards. October 24th, 1922. (Cognate application 31,102/22.). (200,436.)
28,957. "Contact fingers for electric switches." British Thomson-Houston Co., Ltd., and J. Sugden. October 24th, 1922. (200,427.)
29,106. "Electrical ignition apparatus for internal-combustion engines." F. H. Royce and Rolls-Royce, Ltd. October 25th, 1922. (200,428.)
29,515. "Electric switches." British Thomson-Houston Co., Ltd. October 28th, 1921. (187,903.)
29,602. "Electric motor controllers." Igranic Electric Co., Ltd. (Cutler-Hammer Manufacturing Co.). October 30th, 1922. (200,431.)
29,839. "Electrical driving power applied to clocks." S. J. Wise. November 1st, 1922. (200,433.)
30,794. "Arc welding." M. de Coninck. November 11th, 1921. (188,081.)

1923.

1,399. "Magneto electric ignition apparatus." R. Bosch Akt. Ges. January 18th, 1922. (192,071.)
1,424. "Electro-deposition of metals." A. Waldberg. January 19th, 1922. (192,072.)
3,844. "Hydro-electric installations." A. Huguenin. March 21st, 1922. (195,354.)
13,965. "Railway signalling systems." Automatic Telephone Manufacturing Co., Ltd., and A. E. Hudd. April 28th, 1922. (Divided application of 200,267.) (Addition to 163/418.) (200,462.)
15,709. "Determination of distances by means of reflected sound waves." H. Baron (Signal Ges.). February 4th, 1922. (Divided application on 200,123.) (200,464.)